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MAGAZINE

July 1984
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CP/M Reviewed
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Jake C...

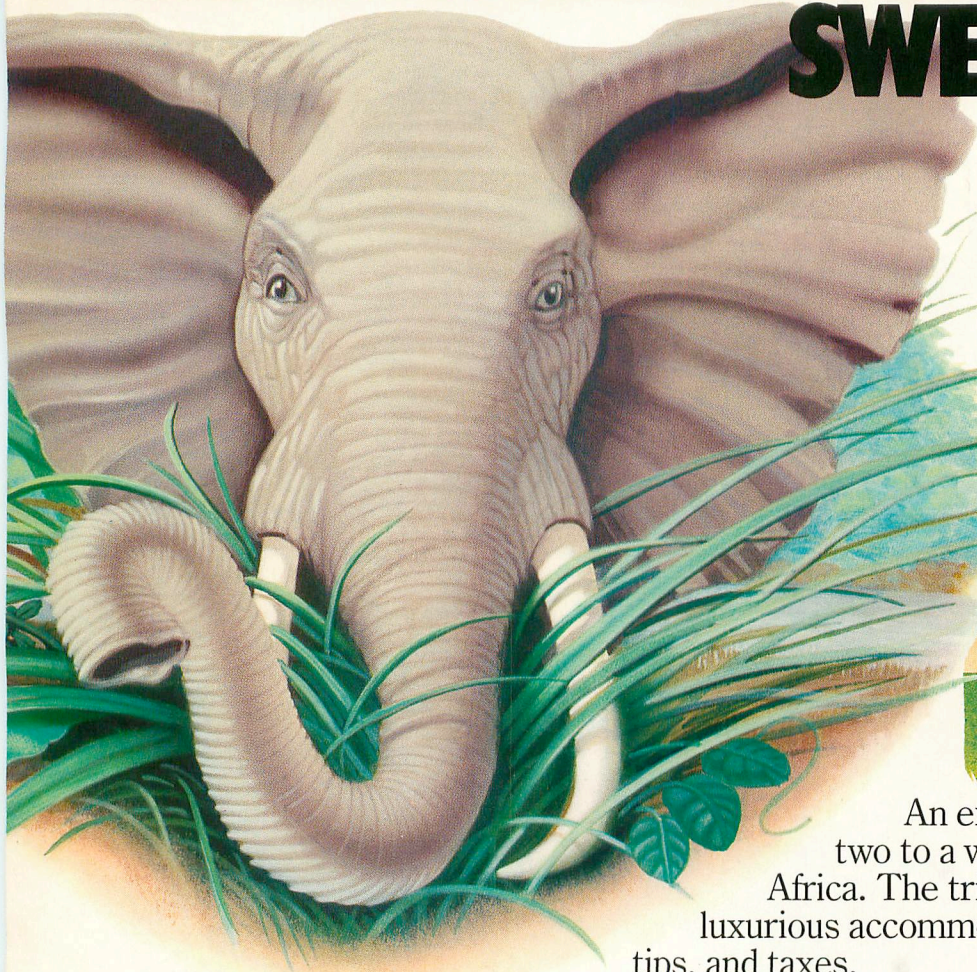
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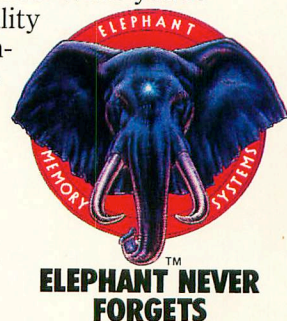
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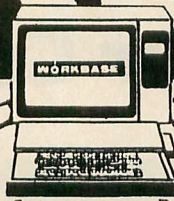
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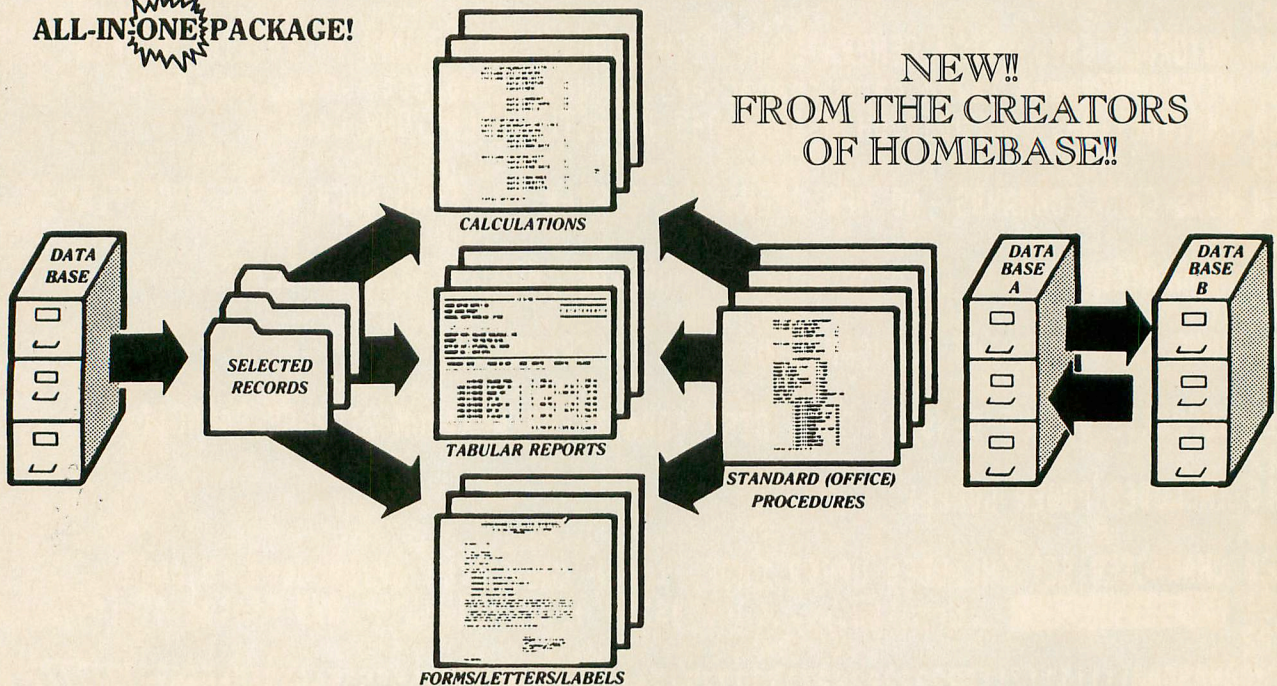
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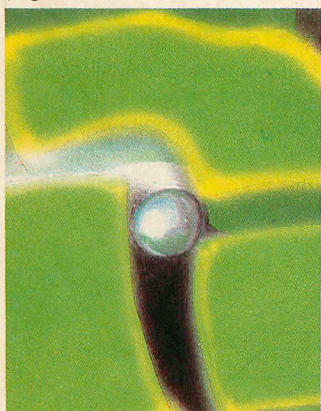
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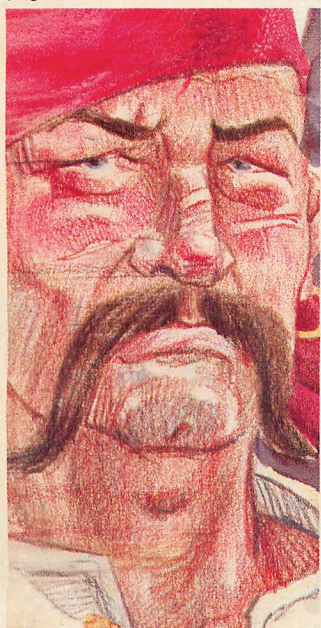
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July 1984



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FEATURES

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| 22/On The Road To OS by E.M. Pass, Ph.D.
Looking at operating systems with hindsight and foresight. | (General) |
| 37/New Worlds Waiting by Eugene Grunby
CP/M is here! | (Review) |
| 42/Disk Encounters by Doug Kelley and Martin Goodman
Patches to kill bugs and create a new DOS experience. | (Utility) |
| 60/System Horizons by Stephen Allen
Studying the intersection of command and OS. | (Tutorial) |
| 69/Dissecting Your ROM by Jake Commander
The final parts. | (Utility) |
| 76/Color Computing For Kids by Jean Plessner
Piracy leaves none of us untouched. | (Education) |
| 83/More Summer Project Winners
Trap 'Em — the last winner! | (Game) |

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|--|
| 4/PEEK (07,84) |
| 4/FOR...NEXT (08,84) |
| 8/INKEY\$ |
| 14/GOTO School by Dr. Paul Kimmelman |
| 18/DEFUSR by Terry Kepner |
| 90/On-Line by Terry Kepner |
| 98/REVIEW\$
Learning to Program in C, Option 4, Test Aid, Color Tutor, more! |
| 112/NEW:PRODUCT\$ |
| 120/END OF FILE |

Cover

"New Horizons" by Peter Macomber. Design by Spindler and Chase.

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n operating system is the program that creates the environment in which you operate your computer. Your computer comes with an operating system — you don't have to enter one via disk, tape or ROMpak — although alternative operating systems are available that can be entered via outside media. The operating system we think of most often is our Disk Operating System (DOS). Operating systems that must be specifically loaded are Flex, OS-9, Uniflex, and others.

Operating systems control how the hardware and memory in your computer use the commands you program into it. The historical background of this function comes from the mainframe days when a computer operator literally stood and threw switches on the computer's surface, acting as a human operating system. To understand how operating systems developed from that primitive form to the elegant programs they are today, GOTO 22, wherein Bud Pass presents an historical overview that will make you really appreciate your built-in system. Part two of Bud's overview will describe operating systems for the Color Computer.

How an operating system actually reacts to your command is nicely described by Stephen Allen. GOTO 60 to follow the List command through your system as it is processed.

Operating systems can be altered, permanently or temporarily, by the user. GOTO 42 for some patches to your Color Computer DOS — one will even correct an error in the original DOS.

Finally, GOTO 37 to read about a new product that will open up lots of heretofore untouchable software packages to Color Computer users. CP/M, a widespread standard operating system, is now available for our computer — and with its arrival, a lot of software will also be available.

Many of you have been begging us to provide you with Jake's computer disassembly faster than we have. We agree, it has been a long time coming. So — here's Jake's commentary to the rest of the disassembly, plus the disassembler and directions to use it — instant disassembly.

Jean Plesser has a special summer article for kids (GOTO 76). She discusses copyrights and piracy — important topics for us all, but especially for young programmers and users just getting involved with software.

And for some summer fun, GOTO 83 — Trap 'Em is the last in our series of Summer Project winners. Trap 'Em takes a quick hand and lots of guts to win.

Don't forget our regulars: GOTO 8 for INKEY\$, GOTO 14 for GOTO School, GOTO 18 for DEFUSR, GOTO 98 for Review\$, and GOTO 112 for New Product\$.

— D.M., Editor

FOR...NEXT(08,84)

AUGUST IS A GREAT time of year — the gardens are in full bloom, the beaches are a delight, and outside chores take up lots of our time. Our August issue will be a special review issue — all the great products available for the Color Computer that will fill your leisure time, help you out in your business and home, and make your computing time easier and more productive. See you then!

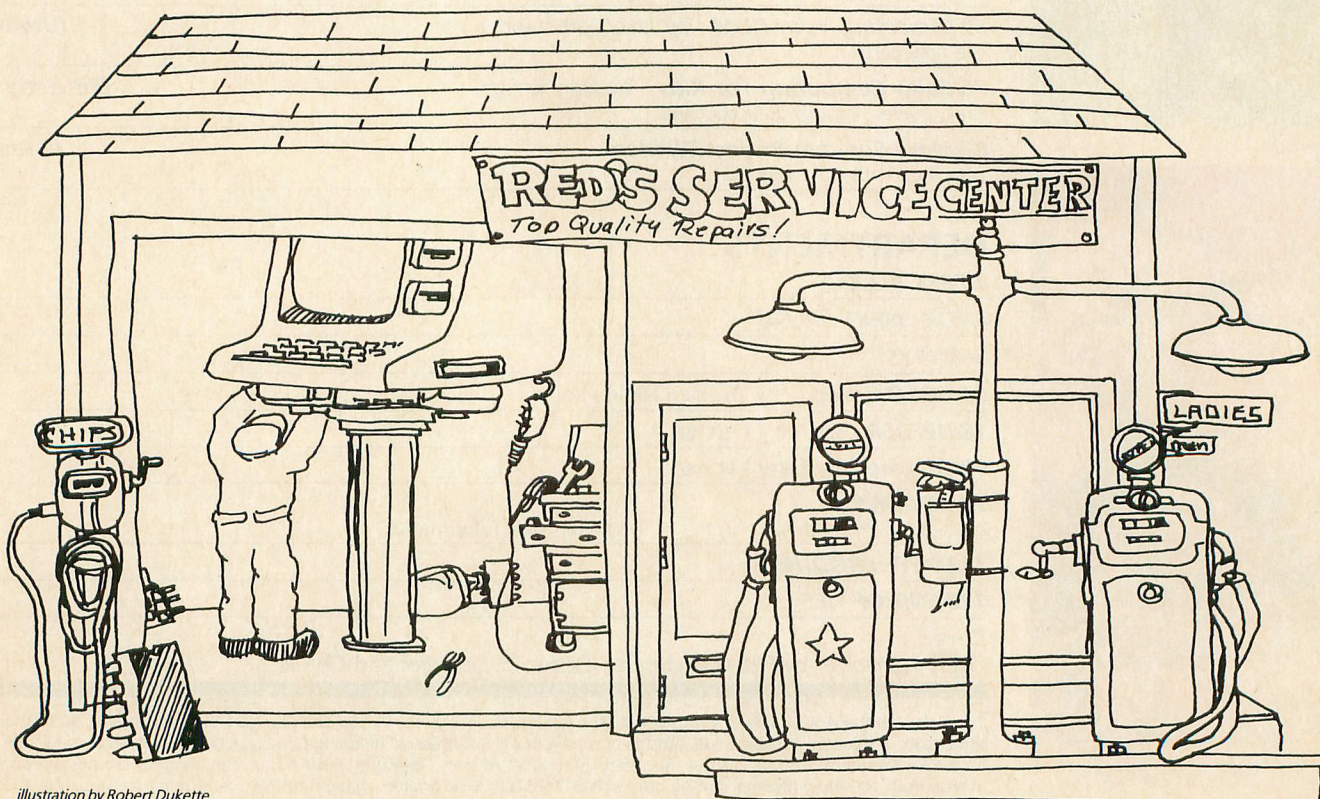
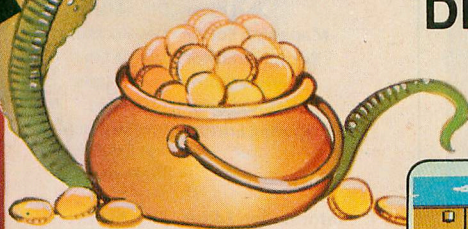


illustration by Robert Dukette

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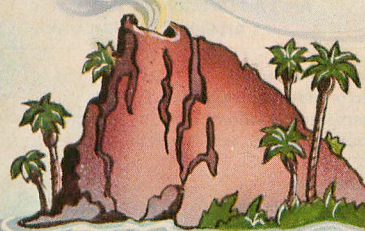
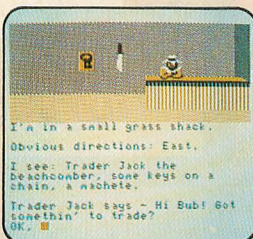
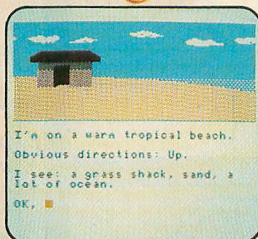
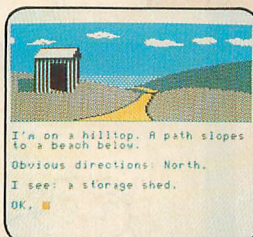
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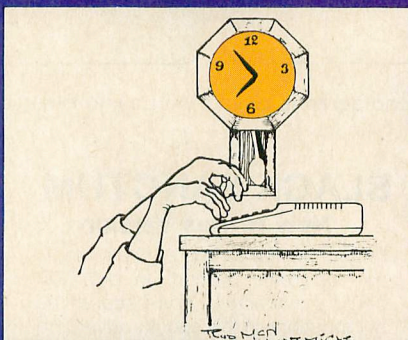
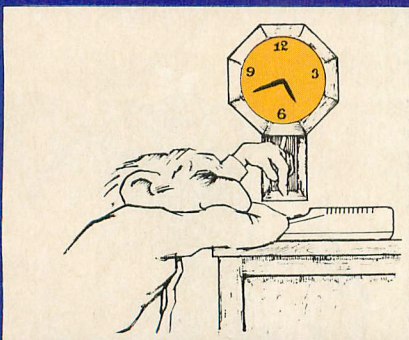
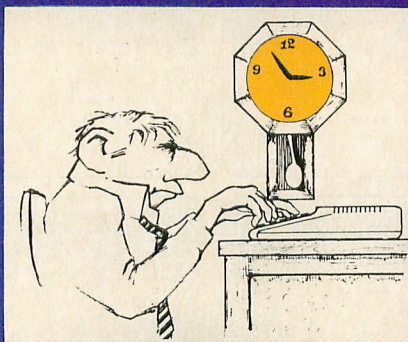
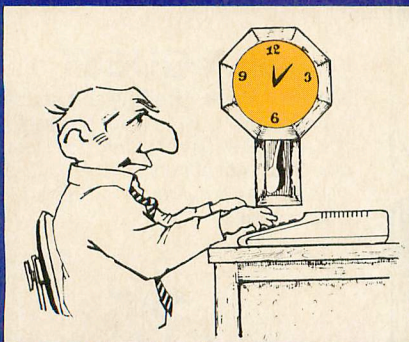
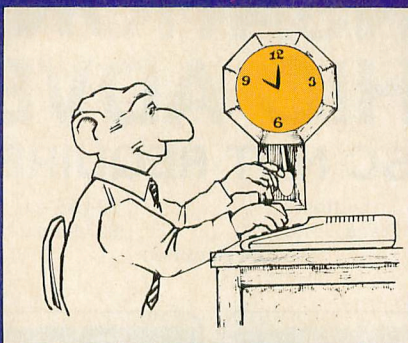
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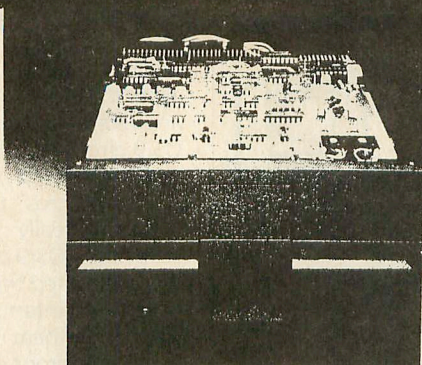
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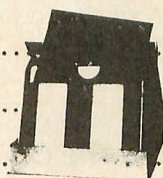
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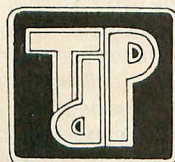


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Different Machines

I have recently heard that the DMP-100, Gorilla Banana, and the VIC-20 1525 printer are all made by the same company. Why should I pay the price of \$250 for the DMP-100 or Gorilla Banana when I can obtain the VIC-20 1525 for only \$199? If I purchased this printer, should I expect any problems with graphics or text? Also, can I obtain the new Color Computer's keyboard from Radio Shack?

In the December issue of **The Color Computer Magazine** there's an error in Dennis Kitz's "Custom Color." It's on page 98 under Listing 4. Line 70 should read: 70 FOR Y = X TO X+ 52 STEP 4: POKE Y,Z.

Jeff Sauer
Perkiomenville, PA

Jeff, the VIC-20 1525 may be made by the manufacturer of DMP-100s and Gorilla Bananas, but it is not the same. It has only a serial version of the GPIB interface; neither the Color Computer's RS-232 serial interface nor the Centronics parallel are directly compatible. You'd easily spend the difference in price on an interface converter.

— Eds.

Battered Mags

I just received my February issue of your magazine and wondered if you could send me the addresses of the pre-finalists. I want to write some of them for a listing of their programs or maybe you could send or publish some of the listings.

I also have a small complaint. Several issues of **The Color Computer Magazine** have arrived pretty battered. The worst was my February issue whose cover was ripped and separated from the magazine, and part of the **TCCM** logo was missing! I don't understand why your magazine occasionally arrives this way when the other computer magazines we subscribe to arrive in nearly perfect condition most of the time.

Ricardo J. Bascuas
Miami, FL

1. We are currently making arrangements to publish some of the finalists' games.

2. It seems postal equipment finds magazine ink and paper to be nutritious. For some reason the machinery found our February cover to be more delicious than others. As of the April issue we switched our mailing location. Hopefully the new post office has better trained machines.

— Eds.

More On The OS/9

The article on OS/9 by Norman Garrett (March, 1984) is well written and very informative. It gives a good overall description of the OS/9 operating system. I came across one detail, however, which is a bit misleading.

In the "Using Assembly Language" section of the article, Norman mentions the OS/9 macro assembler and many documented macros available. I wish to clarify those terms.

The OS/9 assembler is not a true macro assembler. It does not recognize the MACRO di-

rective; therefore, it does not allow the programmer to create and reference new macros. The OS/9 directive is the only macro which the assembler uses.

The "macros" the article refers to are really system service calls to the OS/9 operating system supported through the use of software interrupts. The code to perform them is not present in the user program. In the case of user defined/referenced macros, the code for the macro is expanded into the program code during assembly, so every macro reference generates all code needed to perform that function.

I have the first release of Color Computer OS/9. I am unaware of any updates since then. If there is one which includes a real macro assembler, I would like to know. (I realize there are other commercial assemblers available.)

Curtis A. Whitley
Chesapeake, VA

No Defense

I recently typed "Defense," a program listed in the December issue of **The Color Computer Magazine** into my computer, and found there is no part of the program that looks like the picture displayed on page 73. Am I right or is there a program error? If there isn't a screen of this type, I feel it is very misleading to have this picture in the midst of the text. I felt I wasted several hours of effort since the program was not the one I expected.

A concerned reader and tired typist.

Tim McCaughan
Evanston, IL

We goofed. The screen display that we thought was from "Defense" isn't. In fact, we aren't sure where that screen came from! Any takers out there?

— Eds.

SPAZMORG

As a retired electronics engineer, I have been enjoying my TRS-80 Color Computer for

nearly three years and **The Color Computer Magazine** since it first came out. I have been very happy with the magazine, but would like to comment on your game contest Basic Grand Prize winner, "Spazmorg."

The game has great graphics and sound effects, good instructions, and originality of game concept, but there it ends. If logic, strategy or skill are required I could not see it.

One could prolong the game by retreating quickly from the spider's den. Otherwise you went from room to room until you found the baby, then followed him until you were eaten by his mother or by the spider — or until he entered a room with no other doors open, which allowed you to catch him and win. You could never catch the little bugger if any doors were open.

I could win about every fifth or sixth game. It seemed the game was controlled purely randomly and no skill on my part could change it. Maybe I missed something. I hope so.

Thank you for a good publication.

Floyd Keirnan
Orange, CA

When I wrote "Spazmorg," I wanted a graphic game with more meat in it than the average shoot-'em-up game. It had to look good and offer more challenge than to see how fast one could move a joystick and push a button. "Where's the beef?" Mr. Keirnan asks. Let me explain.

Mr. Keirnan's problem was in his approach to the game. His strategy was to chase the baby Spazmorg from room to room hoping to catch it. Well, that's one way to play, but it lacks fun. You die a lot, and win with fairly bad scores.

It's not a chase game. The object is to trap the Spazmorg. He's faster than you, so you have to outsmart him by forcing him into a room from which he can't escape.

This is hard since the player can only see one room at a time. The challenge is to visualize all nine rooms and 12 doors in your mind, then plot the logical moves to trap him. Remember, you control the doors.

Many other hazards present problems and decisions. Regaining your bearings when hit by a wind is one. Remembering which room the spider is in after finding him is another. All these factors have rational moves the player can take in dealing with them. He has to use memory and better judgement.

As in adventure gaming, it takes time to learn the tricks. When experience increases and skill develops, the player will find himself winning five out of six games, and with good scores. The words logic and skill were not used without reason. I encourage Mr. Keirnan to try again. There are ways to beat the Spazmorg.

Al Bogdan

TIMS Revisited

We were, for the most part, pleased with your review of the Tape Information Management System (TIMS) in the January, 1984 issue of **The Color Computer Magazine**. I would like to clarify a few errors, however.

TIMS is fully disk-compatible. All you have to do is SKIPF over the auto run loader, CLOAD and SAVE"TIMS". TIMS has been simple to move to disk for several reasons: our present customers do not have to purchase an upgrade or disk version when they purchase a disk system — they can continue to use the program they have; future customers can purchase and use TIMS regardless of the system (tape or disk) they have; and this disk compatible feature is part of our "user-oriented, menu-driven, easy to use" claim. When TIMS is loaded from disk, the program can read in from either disk or tape and save to either disk or tape. Also, there is a facility for defining and storing report formats. The formatted file can be sent to tape, disk or printer. You can then use a word processor on your TIMS file to be even more creative with the file than the flexible formatting features allow.

Finally, although TIMS can be used with 16K, we recom-

mend 32K because files can be so much larger. We have had good experience with some 64K programs, which have allowed us to create even larger files.

Susan P. Davis
Sugar Software

Susan Davis' letter has prompted me to re-examine TIMS. I agree with her (well, sort of) on one point, but I'm afraid we still differ on another.

First, the disagreement: disk compatibility. Each side of the TIMS tape contains a Basic program that handles most of the work, followed by a machine language file — the sorting routine, I believe. In addition, side A (which contains the "compressed" version of the Basic code) leads off with Sugar Software's Auto-Run loader routine. Ms. Davis rightly points out that you can skip over this with a SKIPF command (SKIPF "TIMS", actually then CLOAD the main program and save it to disk. The problem remains of what to do with the machine language file.

In normal operation the cassette deck is left in Play mode when TIMS is run; the program loads the machine language portion itself. For disk operation, then, you have to copy this second file and change a Basic command or two. The Basic code reveals that the machine language is stored on tape with the file name SSBDM, and should be saved with the three addresses. They are 15734, 16383, and 15734 (at least for 16K operation). Changing a CLOADM and a SAVEM in the code to a LOADM and a SAVEM, and saving SSBDM on disk, will indeed result in a pair of routines that run without reference to the tape.

However, the program still wants to read and write cassette data files! Additional surgery on the code would fix that, but that's not what I call disk compatibility. I suspect Ms. Davis also has something else in mind, and I'd welcome her comments. I may have an outdated version.

On to the second topic — when I said TIMS does not permit user-defined report format

storage, I was thinking of formats that are stored separately from the data. Ms. Davis rightly points out that TIMS incorporates the most recent format definition in the header of the data file when it is recorded on tape. Thus you can set up multiple reports — you just have to re-record your data file for each one. The technique uses up a little tape, but it works. I should have caught that.

Scott L. Norman
Framingham, MA

Graphic Pak Incompatibility

After reading the review of Radio Shack's "Graphic Pak" in the February, 1984 issue of **The Color Computer Magazine** I thought I'd add information about the program.

I have 32K and a Radio Shack DMP-120 printer. After purchasing the graphic program, I had problems getting a print-out of the results. I got in touch with the salesman who sold me the printer. He said the program would not work with the 120 but would with the DMP-200. I was unhappy about that.

My money was refunded, but I would buy the program again if Radio Shack made it compatible with their new printers.

Cruncher Bug

I have discovered a bug in the article "Cruncher" by William Harris, published in **The Color Computer Magazine** (January, 1984). I have "killed" this bug. As an example, if my original Basic program has 20 PRINT " Place a formatted Disk in Drive " DR " , And press <ENTER>

The Screen Print Program and PTFX16K program would not work either.

I have been very happy with the DMP-120 and it seems to work very well, but I would like to be able to use its graphics capabilities.

Jeffrey W. Wilson
Midland, TX

Color-80 BBS Comments

I would like to comment on the review of our Color-80 BBS in the April, 1984 issue of **The Color Computer Magazine**. The review says the system is an upgrade of earlier versions. In fact, we wrote it from scratch. It also says the system's database supports up- and down-loading. The database is just a list of files: it's the file transfer section that does the up- and down-loading.

Also, the bulletin board's operating system source code is not only "not included" in the documentation, as your reviewer pointed out — it isn't even offered. Regarding modems, the review mentions only two that can be used, when actually others are compatible as well.

Shawn Jipp
Silicon Rainbow Products
Sunnyvale, CA

and if I crunch the program with the Cruncher as is, Line 20 will be:

20 INPUT " Place a formatted Disk in Drive "DR.
The remaining text will be eaten up.

To kill the bug, change Lines 1320 and 1420 as in the Program Listing, add Lines 1321, 1322, 1421, 1422 to it and reassemble the Cruncher (below).

1320	CNUM	CPMA # \$22	QUOTE ?
1321		BEQ GETSTR	GET STRING
1322		BSR NUMCHK	CHECK FOR NO.
1420		CPMA # \$22	QUOTE
1421		BEQ GETSTR	
1422		BSR SPTEST	

Ashok Basargekar
Orange, CA

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Send a true line break.

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53,000 character buffer (64K).

Split buffer option (64K).

10 macro keys.

Four buffer send modes (dump, prompted, manual & time delay).

Buffer size indicators (bytes used & bytes remaining).

Buffer editor w/auto key repeat.

Scroll forward & reverse to view buffer & print viewed screen option.

Selectable printer formats (line feeds, etc.).

Selectable trapping of incoming characters.

Print while receiving data*.

Spool received data while receiving more (64K).

Buffer editor has these features:

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Clubs

Georgia Club

For information on the Color Computer Users' Club in Savannah-Hinesville, GA contact William Mason, 417 Timberlane Circle, Savannah-Hinesville, GA 31313 or call (912)368-3900.

Gainesville, FL

Alachua Color Computer Users' Group will meet on the second Tuesday each month at 7 p.m. at the Operations Center behind the Kelly Power Plant at 555 S.E. 5th Ave., Gainesville, FL. For more information contact: Al Kirk at 4617 S.E. 2nd Pl., Gainesville, FL, 32601 or call (904)377-6285. George McDonald may be contacted at Rt. 2, Box 530, Alachua, FL 32615, or call (904)462-5392.

Jefferson City, MO

A Color Computer Users' Group is forming in the Jefferson City/mid-Missouri area. For more information write: CoCo Mug, c/o Wayne Johnson, 900 Rock Hill Rd., Jefferson City, MO 65101 or call (314)893-2789.

NY Club

Call (518)644-9927 for information on the Adirondack Color Computer Club.

Illinois Club

The Northern Illinois Color Computer Club (NICCC) meets every fourth Tuesday at Des Plaines Public Library. For more information write Rich Ekstrom, 580 Milton Lane, Hoffman Estates, IL 60194 or call (312)885-2573.

Boston, MA

The Greater Boston Super Color Users' Group meets every second Thursday at Sylvania Technical School, 63 Second Ave., Waltham, MA. The users' group publishes a monthly newsletter, The SCUGBUG. Color Computer users may contact John DeBay, 100 Central Street, Waltham, MA 02154 for more information.

Fix(05,84)

EPROM Burner Fix

The "EPROM Programmer" schematic (page 32) should include a connection from pin 16 of the ETM socket to +5 volts. The Darlington transistor should be labeled as an NPN type.

Fix(04,84)

Disk Editor Fix

In "Devil's Disk Editor" (page 106) Line 680 should be changed to 680 T = INT(FT/2): S = (1 AND FT) * 9 + 1: IF T > 16 THEN T = T + 1

Fix(03,84)

Cashbook Fix

In the "Cashbook" program (page 35) Line 7050 should have a space between variable C2 and THEN.

Speller Fix

The article "Speller" mistakenly directs the reader to press Enter to enter the file set-up (word entry) mode. To use this mode, answer the name question with ENTER. If you like the directions as printed, you may omit the word ENTER from Line 50, but leave the double quotes there (with nothing in between).

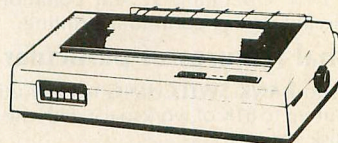
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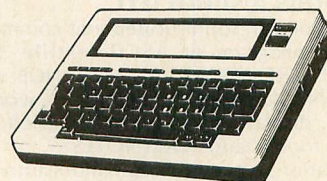
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By Kevin Herrboldt

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By Dan Nelson

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By Tim Nelson

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RAVED ABOUT IN THE APRIL 1983 "RAINBOW!"

By Tim Nelson

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GOTO SCHOOL

by Dr. Paul Kimmelman

NESTLED AWAY IN CENTRAL Florida at one of the world's most popular tourist attractions is something very dear to each of us. Would it surprise you to know that our Color Computer is inside Walt Disney's EPCOT Communicore Teacher Center? I must admit I was pleasantly surprised to learn this. My curiosity compelled me to investigate further, and I ultimately discovered a teacher's technology paradise. If technology is what inspired you to become a computer fanatic — then have I got some stories for you!

At times I think we educators can't see the forest for the trees. We read article upon article, book upon book, all telling how to use computers or how easy it is to learn to program. Better yet, we need the sales pitch which scares half of us into fearing our children will fail the SAT exams if we don't rush out and buy them a computer. Threats aside, what *does* the computer mean to our future? What may happen to our society that is "good" because of computers? Future World provides an answer to these questions.

Future World is run by a Disney World computer that performs 72,000 functions per second. The imagination that went into its creation is outstanding. To quote David Brinkley, "It is the most imaginative and effective piece of urban planning in America, and this is totally aside from the Mickey Mouse park area itself." If this is where the computer age will lead us, get me a ticket. From making dinner reservations on a telephone that lets you see who you are talking to (yes, be careful of your facial expressions) to the solar powered toys in the gift shop, technology is everywhere. Observed from the context of Future World, computers could stimulate critical thinking skills: a task that should *never* leave our schools.

Walt Disney's original dream for EPCOT called for it to be a laboratory where creative experiments in applied technol-

ogy are encouraged. In a sense EPCOT is meant to become a "living blueprint" for the future. Before I discuss the Teacher Center, let's take a short trip through Future World. Caution! Words cannot adequately describe the sights. Future World is an indescribable educational fantasy trip. It can make learning fun, a Disney educational goal since it began marketing educational products.

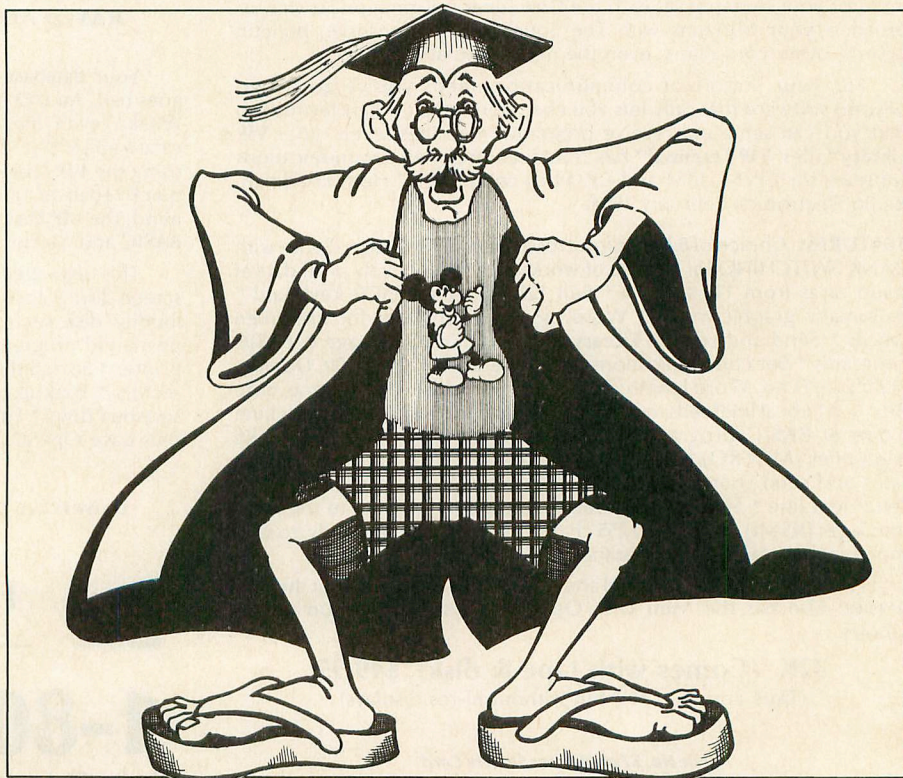
Future World

Future World is currently composed of seven major exhibits: Spaceship Earth, Communicore, Universe of Energy, Horizons, World of Motion, Journey Into Imagination, and The Land. A quick tip: if what I say interests you, and you tour the exhibits and want to use your newfound knowledge in your classroom, a

do it! We'll first enter *Spaceship Earth*, the gateway to Future World. If trivia facts impress you, be sure to remember that Spaceship Earth is a "geosphere," the symbol of EPCOT Center, and the largest structure of its kind in the world — 180 feet high.

Once inside Spaceship Earth you will take a ride that illustrates the dynamics and the importance of communications, from primitive cave sketches to futuristic technologies. The exhibit leaves little doubt that we have come a long way since hieroglyphics were used to communicate. As a matter of fact, when I looked at the future of communications it somehow outdated my Color Computer and modem!

Can you imagine going back to the days of dinosaurs and primeval forests? Consider the fact that your trip is power-



method exists. Classroom guide lesson plans for the exhibits have been written by the Disney staff (wait 'til we get to the Teacher Center).

It isn't important in what order you view the exhibits. If you can avoid a line,

ed with the aid of 80,000 solar cells on the roof. After avoiding fierce volcanic eruptions, you return to be entertained on a 210 foot screen depicting laser-like computer images demonstrating that people will build an energy bridge to the

future. All of this takes place in the Universe of Energy exhibit.

Next stop, World of Motion. This exhibit takes you a long way back in time to the cave days. I guess the wheel was to motion what the computer is to electronic technology. Here you can view transportation systems of the future by actually becoming a participant. What a fantastic opportunity for a student who is working on a project describing transportation from its beginning to where it may take us!

OK, enough for realism. Let's go to Journey Into Imagination and fantasize for awhile. Sounds like kid's play, doesn't it? Don't get too involved in the room where every step you take creates music, or where you create works of art with what I call a light pen — excuse me: "electronic palette."

The 3-D movie in Magic Journeys was frighteningly real. Wouldn't someone want to know that the movie was made with a 65 mm 3-D camera capable of shooting 75 frames per second? Never mind that most movies are shot at 24 frames per second, just get that butterfly off my nose. Journey Into Imagination was another of the educational-type exhibits that was just plain fun. Can learning really be this much fun?

Now let's go to The Land. If you expected your tour to be plots of land with little plants growing, you were wrong. The Land exhibit was designed with the assistance of the Environmental Research Lab at the University of Arizona. Your boat ride will present new food production techniques, for example: growing plants with only one-tenth of their normal water requirements, or even "stacking them up." Even more interesting was discovering that it may be possible to grow all food in greenhouses, a potential solution to food shortage problems.

What will really happen in the future? Where will we live? What would it be like to live in the ocean? Our next exhibit will provide some clues. Horizons features "future" ocean, urban, desert, and space habitats which illustrate the potential of the twenty-first century. Maybe it wouldn't be so bad living in space, but I'm not too keen on living under water. I had the choice at the end of the tour to see more about what it would be like in outer-space. Just push the button, and away I went.

Communicore

Finally, we're at Communicore, the home of the Teacher Center (parents can use it too!). The two buildings that com-

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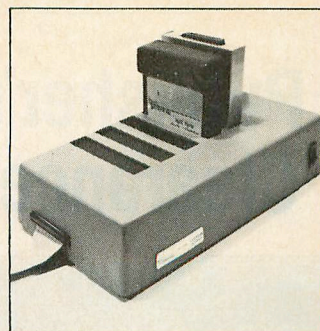
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prise Communicore will captivate any computer fanatic because of the countless hands-on opportunities. Ride a bike and find out just how much work you would need to do to power an electrical plant to run your home. You can talk to a robot, SMRT-1, play video games, even test your memory.

What does all this mean? To me, EPCOT represents what **The Color Computer Magazine** is all about. From a small computer in the Teacher Center to the world of the future lies a very important educational trail. The Color Computer may serve as the pioneering vehicle for our future engineers. How can we apply this knowledge to make it useful and practical? EPCOT's message should emphasize the importance that educators convey knowledge about not only how computers work and how they are programmed, but how they will change the way we live. It doesn't stop there. We should make these learning opportunities fun, not boring. We should make computer literacy classes an experience, not a lesson. Educators call it kinesthetic learning — when we become a part of the experience. I challenge anyone to leave Future World and not want to pursue our little electronic hobby. Certainly the Color Computer is only one small part of the computer world, but not an insignificant contribution.

Parents are welcome to the Teacher Center, but it is a "must" stop for teachers. Because Disney has always been involved with education, it seemed natural to Disney officials to provide educators with a place to translate the meaning of EPCOT for the nation's classrooms.

The Center was designed to provide an environment where educators can meet and discuss technology and education, screen new educational programs, (yes, Disney's Color Computer software is available) and bring the EPCOT experience back to their classrooms.

There is a private screening room to view filmstrips, movies, etc. Computers are available to preview software. An idea exchange board, which even opens up teacher pen pal opportunities, is a wall decoration.

Complimentary study guides are available upon request. The guides contain an instructional unit with lesson plans and worksheets. The guides are divided by color for recommended grade levels. Three levels are represented, Level A (Grades 3–6), Level B (Grades 7–9), and Level C (Grades 10–12). An important component of the lesson plan guide is the "Suggested Follow Up Activities" section. One of the suggested activities

for students in grades 10–12 on communications is to design, in small groups, a "History of Communications" board game. As a suggestion, it is noted that the game could be an episodic maze in which a figure overcomes obstacles on the way to exchange a secret message.

The Land lesson plan guide suggests that students in grades 3–6 be shown pictures of different types of farms, invite guest speakers to their classroom, or even asks them to draw pictures of a farm they would like to own.

The Teacher Center is one part of the Disney educational program. A whole host of educational media is available. Fortunately for Color Computer owners, Disney has produced software for us. The Disney commitment to Radio Shack equipment cannot be treated lightly by educators because of the future educational implications of school lessons being offered directly from EPCOT to the

*"The commitment...
cannot be treated
lightly by educators..."*

classroom. As I was leaving EPCOT Center, I was intrigued by the large satellite dish behind the ominous fence with a sign stating, "Employees Only." With its own cable television channel, the future for Disney holds some impressive educational potential.

I feel that EPCOT represents what education should be all about: fun, motivating, practical, and exciting. I am dismayed by teachers who write me because their administrators don't see any value in computers and simply won't buy them. Dennis Kitz said it best in his November, 1983 "End of File," when he complained of how computers were being used in schools — or did he mean, "abused"? All the doubters should take a ride through Future World and then tell me that computers won't affect our lives every day. Don't tell me computers have no place in our schools. Use them properly. Let students be creative. Show young students how to use the computer.

My tour of EPCOT demonstrated to me what is happening in our world. There is an abundance of knowledge housed in those seven exhibits. EPCOT is a fine example of the excellence that can happen when educators look to a dedicated private sector for help. ■ ■ ■

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I would like to interface the Brother Executron Model 65 electronic typewriter with my Color Computer. I know the typewriter is compatible with a TRS-80 Model III.

The problem, as I understand it, is that the Color Computer has a parallel port and the Model III has a serial port. Can you offer any suggestions?

—H.M., Greensboro, NC

That's not quite right. You have the ports reversed: the Color Computer's is serial and the Model III's is parallel.

To use the Brother typewriter, you need a serial-to-parallel converter box. I know of two currently on the market: Botek Instruments (4949 Hampshire, Utica, MI 48087, (313)739-2910) sells one for \$69, and The MicroWorks (P.O. Box 1110, Del Mar, CA 92014, (619) 942-2400) sells the other, the PI80C, for \$59.95. They both plug into your serial output port, leaving the ROMpak port free. Keep an eye on ads for other converters.

Perhaps Brother makes a serial-to-parallel converter box — check with them. Several typewriter companies are producing the boxes in an attempt to tap into the micro market.

I have a 64K Extended Basic Color Computer and a Gemini-10X printer, connected by an 8010-X serial interface.

I bought a ROMpak program and made copies of ColorFile and Spectaculator on tape, believing I could POKE 150,7 before typing EXEC, to change the printer baud to 4800 from the default rate of 600. But it doesn't work. Can you help?

—T.S., Lutz, FL

Both Spectaculator and ColorFile use their own routines to drive the RS-232

printer port. You must find the baud locations for each of these two programs, POKE in the 4800 baud, then execute the programs.

Unfortunately, I don't know the baud location in either program. Can someone else help us here?

I have a 32K Extended Basic Color Computer, and I want to learn the basics of game programming. That means I should learn to program in assembly language.

I have searched and searched, but can't find a book on assembly language programming. Can you make any suggestions?

—J.B., Tampa, FL

Here are four books that'll get you going in 6809 assembly language programming:

6809 Assembly Language Programming, Lance Leventhal, Osborne/McGraw-Hill, 2600 Tenth St., Berkeley, CA 94710, \$16.99.

6809 Microcomputer Programming and Interfacing, Andrew Staugarrd Jr., Howard W. Sams & Co., 4300 W. 62nd St., Indianapolis, IN 46268, \$13.95.

The MC6809 Cookbook, Carl Warren, TAB Books, Blue Ridge Summit, PA 17214, \$6.95.

Color Computer Programming, William Barden Jr., Radio Shack, #62-2077, \$6.95.

Is there a POKE to disable the Break key on the Color Computer 2 (16, 32, or 64K)? And is there one to restore it to normal operation afterward?

—S.B., Fallon, NV

All the experts I've talked to say that isn't possible. The keyboard scan for the

Color Computer resides entirely in ROM. Your only choice is to intercept the entire routine and write your own keyboard routine that excludes use of the Break key.

If you want to tackle that programming project, get yourself the July 1983 issue of **The Color Computer Magazine**. The ROM keyboard scan routine is disassembled on page 57.

Has anybody tried to use the Brother EP-22 as a printer with the Color Computer? I can't seem to get it to work with my computer (ROM version 1.1).

I've connected these pins from the RS-232 to the printer: 1 – 20 (data terminal ready), 3 – 7 (signal ground), and 4 – 3 (data line out from computer).

Whenever I try to send anything, only the first character is printed. The computer then freezes up and must be reset.

I tried changing the baud, and connecting pin 5 of the joystick port to pin 1 in the RS-232, but neither helped. What's wrong?

—F.M., Elmhurst, NY

You managed to get the first character correctly printed by the EP-22 — that's a good sign. It means that the software is working (baud, word length, stop bits, and parity are all correct).

Since printing immediately halts after this first character, the Color Computer doesn't know that the EP-22 has successfully printed it. The computer is waiting for the EP-22 to signal that it's ready.

You have the wrong Color Computer pin connected to pin 20 of the EP-22: hook up pin 2 to pin 20, pin 3 to pin 7, and pin 4 to pin 3.

I read that if you type EXEC 41175 the screen shows the ROM version number of your computer.

I got to fooling around and tried typing EXEC, followed by different numbers. EXEC 1 froze the keyboard, and another number cleared the screen.

What do these codes mean?

—J.L., Mustang, OK

The Exec (execute) command tells the Basic ROM to transfer control of the computer to the address specified. EXEC 41175 transfers control to a simple print routine that puts the current ROM version number on the screen.

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TYPE Node = RECORD
Next := Node;
NodeName := String(15);

TYPE Month = (Jan, Feb...

MthDys := ARRAY [Month] OF 28..31;

WITH ThisNode DO
Next := Next.Next;

READ (A,B);
WRITELN ('RESULT', 3.2E5*SIN(A));

CASE ThisMonth OF ...

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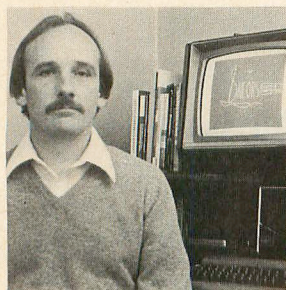


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Just plugging numbers into the Exec command to see what'll happen is something like shooting a bullet into a gasoline storage depot: unless you're very lucky (or unlucky, depending on your outlook, everything is going to blow up.

The first 1023 bytes of RAM are reserved by Basic for pointers and control bytes. Bytes 1024 to 1535 are used for text video display, and from 1536 on up are the graphics pages and any Basic programs. ROM starts at address A000H and runs to DFFFH. The area from E000H on up is reserved for ROMpak cartridges and SAM control addresses.

Unless you know the exact addresses for what you want, most of your POKE-ing will be useless.

I have a 32K Color Computer. I want to buy an Epson RX-80 printer. Can my computer work with this printer? And will Telewriter 64 work with it?

— R.L., San Antonio, TX

The Epson RX-80 is a stripped-down MX-80. It comes with a parallel port. To make it work with the Color Computer you must have a Golden Eagle Serial Interface installed (Epson part #8155, \$95) in the RX-80. Connect pin 20 of the Epson to pin 2 of the R/S, pin 7 to pin 3, and pin 3 to pin 4 (RTS protocol).

The RX-80 should work just fine with Telewriter 64. Other sources of interfaces are Botek Instruments, The Micro-Works, and PBH Computer Products — check ad pages for addresses and other options.

I recently purchased a disk drive for my computer. I own a grey 64K Extended Basic Color Computer with an F board, and the disk drive is white.

I used the drive for a short time, then my computer stopped working. My Radio Shack dealer said the drive goofed up my computer. The company where I got my drive said it should work fine with the grey computer. My dealer said that only a grey drive should be used on a grey computer.

Now I don't know what to do. Can you help?

— S.B., Jetmore, KS

My answer depends on exactly what you bought. If you bought a white-case drive-zero disk drive with a ROMpak disk drive controller, then your computer won't work with the disk drive. The white-case drive-zero disk drive and its controller ROMpak will only work with

the Color Computer 2. The grey-case drive-zero disk drive and its controller ROMpak will only work with the original (grey) Color Computer.

If you already have a grey-case drive-zero disk drive with its controller, and the white-case disk drive is running as drive 1, then the drive shouldn't adversely affect your computer's operation. The only problem is if the white-case disk drive is configured as a drive-zero and has the terminator resistor-pak in place. Only one of the drives connected to your computer is supposed to have the terminator-pak. Having two drives with the paks will cause electronic problems in your computer.

Would you please tell me how to reset data pointers so I can begin a Read statement in the middle or towards the end of my data listings? The loop I presently use is much too slow.

— J.E., North Canton, CT

When you type RESTORE, the ROM simply moves the data pointer from its current position to the beginning of your program. To position the pointer to a specific piece of data, you must place the address of that piece of data in the data pointer address.

To execute a partial restore, you have to know the address in RAM of the piece of data you want to be first.

One possible method of accomplishing this is to place a dummy string variable in front of each position in your data list where you want these partial restores to occur. Then use the VARPTR command to get the variable's address. POKE that address into memory locations 33H and 34H. You'll also have to POKE the line number of that piece of data in locations 31H and 32H. Put the MSB (Most Significant Byte) of the two-byte hexadecimal address in the first location of each pair, and the LSB (Least Significant Byte) in the second address. The memory map showing these locations is on page 46 of **The Color Computer Magazine**, April 1983.

Please explain why the logical operators AND, OR, and NOT are used in expressions such as (8 AND 5)?

— E.A., Mt. Carmel, IL

These commands are known as Boolean operators. They force the computer to compare two variables on a bit-by-bit basis. The variables used with Boolean operators are called the *arguments* of the comparison.

Using constant numbers for the arguments, as in your examples, wastes RAM and CPU time since the result of these operations will always be the same. The result of 10 and 13 will always be 8, so why not just test for 8?

These operators are restricted to integer numbers between -32768 and +32767.

The AND operator compares 16 bits of the first argument with 16 bits of the second argument. A *true* response results when any bits in the two arguments are the same. A *false* response is given if none of the bits are in common. Only those bits that are 1's in both arguments are reported in the answer. That is:

10 = 00001010
13 = 00001100

ANDed = 00001000 = 8

To illustrate the different Boolean arguments and their various responses, mathematicians use a truth table:

A AND B		
A	B	Response
0	0	0
0	1	0
1	0	0
1	1	1

When used in an If...Then statement, the Boolean true response will execute any code that follows the Then. Otherwise the logic falls through to the next statement below the If...Then. If you're using If...Then...Else, a false response will execute the code following the Else.

The AND operator is usually used to test for specific numbers by comparing one variable argument with a fixed argument. For example:

IF 128 AND A THEN 100 ELSE 200

This statement will execute Line 100 only when A is 128 or more (bit seven of values from 128 to 255 is always a 1).

The OR operator returns a true response when either of the two arguments has a 1 in its bits. A false response is given only if both arguments are 0.

A OR B		
A	B	Response
0	0	0
0	1	1
1	0	1
1	1	1

The NOT operator is used with a single argument to invert (or negate) the Boolean value of that argument; that is, it's true only when the argument is zero.

NOT A	
A	Response
0	1
1	0

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On the Road

*Building bridges, making in-roads:
the development of operating systems.
Part I.*

by E.M. Pass, Ph.D.

OPERATING SYSTEMS are used on mainframe computers, mini-computers, and microcomputers. They form the vital link between people and computer circuits, regardless of the computer's size.

Operating systems that run on the Color Computer include Radio Shack's DOS, TSC's Flex, and Microware's OS/9.

Operating system functions fall into several categories: job management; task management; input-output management; main memory management; and secondary storage management. Not all operating systems provide all these functions, and some provide functions which others perform externally or do not support at all.

One manufacturer has come up with a technique for running CP/M on the Color Computer. You simply install a plug-in board containing a CPU capable of run-

ning CP/M, a PROM or ROM, and other circuitry which disables the 6809 in favor of the CPU on the board. (Ed's Note — a second CP/M system should also be available by the time this article is in print.)

Originally operating systems' functions were meant to make it easier to write, debug, and run programs. As mainframe computers became more complex, and especially as the demand for computer time and resources grew, operating systems became more complex and offered many more facilities. Computer hardware then became more sophisticated.

The development of increasingly-complex software and operating systems on increasingly-complex mainframe hardware was repeated over a much shorter time on micros and minis. At one time micros had 8-bit data paths, minis had

12-bit to 24-bit data paths, and mainframes had at least 32-bit data paths. The definitions of mainframes, micros, and minis have become more variable, though. Now there are micros with 8-bit, 16-bit, and 32-bit data paths, and the trend towards more powerful and faster micros continues. Manufacturers may, in fact, decide what to call their machines based on the markets they hope to reach.

Now let's look at major operating system functions.

Job Management — every operating system provides some kind of job management. It may take the simple form of letting a single user load and start programs (as on first-generation mainframes, and simple operating systems such as Radio Shack's DOS for the Color Computer). It may take the much more complex form of controlling all the resources of a computer system in a multi-

to OS



programmed or multiprocessor environment.

Job management allows some system-access security and accounting. A potential user must log into the system before being allowed to use its resources.

Every operating system provides some form of task management, as well as some form of job management. In simple operating systems such as Radio Shack's Color Computer DOS, they are the same. However, many operating systems provide separate task-management facilities. (I use the term *task management* rather than *program management*, since a program is composed of one or more tasks.)

The tasks associated with running programs usually concern resource allocation. Main memory space is always required to load the program and data areas before the program can begin execution. Time is required on data channels or hardware device drivers to transmit information to and from main memory. CPU time is required to execute the instructions in the program and in the operating system.

In monoprogrammed systems (systems that have only one task), resource allocation is much simpler than in multiprogrammed systems. Much of a monoprogrammed system will be idle at any given time, since very few programs can occupy more than one part of a system for more than a short time. On microcomputers, "wasted" computer power is not a great issue. The value of "recovered" computer power must be weighed against the increased complexity of the hardware and software required to support multitasking, especially for non-business users.

The earliest serious attempts at multitasking were of two main types. One was the development of programs, such as the time-sharing interpreter, which performed only a tiny bit of work for each user before going to the next, giving

each user reasonably good service unless several requested heavy computations at the same time. Several Basic interpreters for 6800 and 6809 microcomputers were made multi-user by adding interval timers and by bank-selecting 16K- or 32K-byte memory boards for switching among users.

The other method was the development of background interrupt-driven spoolers (Simultaneous Peripheral Operation On-Line). The Flex operating system supports spooling from disk to a printer, although not on the Color Computer.

*"On microcomputers,
"wasted" computer
power is not a
great issue."*

Neither approach requires a sophisticated task-management system, but neither provides really good use of all parts of the computer system. Early attempts at task-management software and hardware often wasted more resources than they saved; this trade-off is still a major concern. Programs used on a multitasking system must be *re-entrant*; that is, they must be designed to execute the same way no matter how many times they have been partially executed. The programs cannot be self-modifying, and data pointers must separate instructions used consistently to reference variable data from the program. Also, data files should be available to all users whether they be on direct-access storage or in memory.

The dynamic-allocation form of task management is used in Unix, CP/M, Flex, Uniflex, and OS/9. A command line interpreter elicits the name of the program and then runs it if sufficient main memory is available.

The program is responsible for requesting that the operating system open and close files, provide memory space, and allocate resources. This approach simplifies or eliminates complex job or program schedulers in favor of simpler command line interpreters.

The more sophisticated operating systems (including MVS, Unix, Uniflex, and OS/9) let programs generate new tasks for the operating system to process asynchronously or synchronously with the original task. As a result, the terms *multi-programming* and *multitasking* are almost interchangeable.

This greatly simplifies some applications: One program can spawn and monitor the progress of a number of special-purpose tasks. It even simplifies parts of the operating system itself: The command line interpreter can generate and wait for the completion of programs requested directly by the user or indirectly from a command script.

An important aspect of task management is the ability of tasks to request actions of the operating system. Under some systems, the supervisor handles the program requests, in addition to its other duties. Under other systems, the operating system provides a separate facility for handling direct requests.

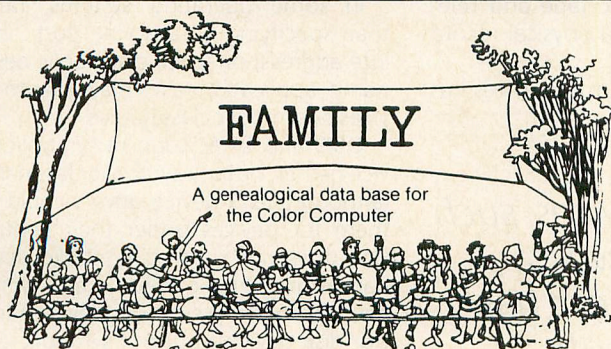
Requests to open files, provide additional main memory and spawn a task are all examples of operating system calls. On many hardware systems, access to peripheral devices is possible only by requesting operating system services through calls.

Almost all supervisor activity begins with an interrupt or with a system call, which is usually also an interrupt. Familiar exceptions are Flex, in which system calls are direct-vectored subroutine calls, and CP/M, in which system calls use the RST instruction (effectively a short subroutine call to a fixed low address). OS/9 uses the SWI2 instruction for system calls, Uniflex uses the SWI3 instruction, and MVS uses the SVC instruction, all of which are interrupts.

On systems with protected-instruction modes, an interrupt is a means by which the operating system regains control in the protected mode. The exact nature of interrupt systems and of processing depends on the hardware.

A very powerful and useful facility provided by the supervisors of certain operating systems is *extended instruction emulation*. Instructions invalid on the

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hardware are used in application programs. When they are encountered, an invalid-instruction interrupt passes control to the operating system, which has routines that emulate the extended instructions. Control then passes back to the program. If the same program is run on hardware that recognizes the instructions, it will run much faster.

This method is often used to emulate floating-point or decimal-arithmetic hardware on smaller or cheaper CPUs without requiring different compilers or libraries.

Trace facilities are similar to emulators. The hardware interrupts the program execution after every instruction, letting the user trace the execution. Motorola 68000 hardware supports extended instruction emulation and instruction trace.

Input-Output Management

A major component of any operating system is the input-output control system (IOCS). The IOCS simplifies memory input and output in single-user systems. The degree of control over the hardware and software varies from system to system.

Each class of input-output devices has some basic unit of information, the

smallest amount of data that can be transferred in one operation. This unit is usually called a *physical record*. For some devices, such as disk drives, a physical record has a fixed length. For other devices, such as magnetic tape and telecommunications lines, a physical record may vary in length.

Each class of input-output devices has

"For some devices, such as disk drives, a physical record has a fixed length."

its own means of using or generating records. The latency time, or the time between a request and a response, also varies significantly among devices. Access to a device can be either sequential or random.

The IOCS performs the following tasks in most operating systems: translating; scheduling; interrupt-handling; and buffering.

Translating input-output requests is an important function of most IOCSs. Since

control of input and output is centralized in the IOCS, the definition of symbolic or generic device names is made much simpler, and, in multiprogrammed systems, is almost essential.

In some operating systems, rather than specifying an absolute port, absolute address, or specific symbolic device name, application tasks may refer to devices by symbolic class names.

OS/9 and CP/M support symbolic device names, but not symbolic class names (although OS/9 device drivers could use them for devices under their control). Flex does not support symbolic device names or symbolic class names. Uniflex and Unix support symbolic device names (for disk devices) but not symbolic class names. OS, VS, and MVS support absolute port numbers, symbolic device names, and symbolic class names.

The symbolic class names are used by most OS, VS, and MVS application programs for most allocations. Symbolic device names are used for devices with unique characteristics. Absolute port numbers are usually used only in very special cases, such as in a telecommunications monitor.

Interrupt handling is another important low-level function. Interrupts that are caused by data channels completing their assigned operations are eventually



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passed to the IOCS for processing. On simpler systems, an input-output interrupt may indicate that data is available from an input device or that an output device is ready to accept more data.

Buffer management is essential to the efficient use of computer systems, especially the larger ones. Buffering reduces the number of input-output hardware operations required to satisfy user requests and to correspond to the multi-byte physical record sizes on many types of devices.

Buffers are allocated in several different ways. An operating system may support one or more of them, although few support all. The simplest technique is the fixed, single-buffer allocation method used by Flex and CP/M for disk files. Its primary advantage is simplicity. Its primary disadvantage is that it eliminates the possibility of read-ahead or write-behind.

The next simplest technique, used by many multiprogramming operating systems, is double-buffering. In this case, the operating system can be filling or emptying the alternate buffer while the application program is processing the primary buffer. An extension of this method is fixed multiple-buffering, where more than two buffers are assigned to the files. The biggest advantage of multi-

ple-buffering is increased performance; the disadvantages are increased complexity and increased main storage requirements.

IOCSs support several means of transmitting data to and from the application program. The most common modes are called Move, Locate, Substitute, and Direct under MVS, but are used in many

*"High-level interfaces
provide facilities
far beyond those
on microcomputers."*

other operating systems without explicit names.

In Move mode, the application program provides the address and length of a work area containing data to be read or written to the IOCS. Flex and CP/M use this method for communication with the console, although the data length is restricted to one byte. OS/9, Uniflex, and Unix use this technique exclusively. MVS supports this technique, among others.

In Direct mode, the application pro-

gram places or retrieves data directly in the buffer to be used in the input or output operation. Although it is the lowest-level mode, it is sometimes used even with large operating systems to increase performance, or for special devices. It is very often used with microcomputer operating systems such as Flex and CP/M.

The high-level interfaces used by the IOCSs on large mainframes provide facilities far beyond those now provided on minicomputers or microcomputers. MVS manuals call these high-level interfaces "access methods." Access types are termed "queued" and "basic," representing multi-buffered sequential access and single-buffered (potentially random) access. Data organizations are called "sequential," "direct," and "indexed-sequential," representing sequential files, random files, and special files with qualities of both sequential and random files. Most microcomputer IOCSs have very few different access methods. Flex and CP/M use basic sequential and direct methods, while OS/9, Uniflex, and Unix use basic sequential and direct, in addition to queued sequential methods.

Main Memory Management

Main memory management in a general-purpose computer system is a prob-



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lem because the main memory is never large enough to satisfy all the demands on it. The operating system must also protect memory from damage due to accidental or malicious accesses by application programs. Allocation problems are aggravated when memory must be re-used.

Many overall memory management structures are now in use. Static memory allocation schemes were quite successful on some early systems, and are still used on some microcomputer operating systems. Examples of operating systems using static memory allocation are Flex, CP/M, and the Color Computer DOS. In these systems, programs are compiled and loaded into fixed memory locations and the operating system provides no system calls for allocation. As static memory allocation schemes are not generally conducive to multiprogramming or multiprocessing, almost all systems supporting multiprogramming or multiprocessing use some form of dynamic memory allocation.

Memory swapping was one of the first dynamic techniques used to solve the problem of insufficient memory. In memory-swapping, all memory assigned to a program is kept contiguous. At an appropriate time, the program's entire memory assignment is written to a direct-access device, and another program's entire memory assignment is read from a direct-access device, replacing the original contents. Then the new program is executed from its previous point of interruption.

The advantages of this technique are its simplicity and the partial memory protection it provides without any additional hardware. It can be put into place in a system with existing non-time-dependent programs without modifying the application programs. Unixflex uses disk swapping when there isn't enough memory for all tasks in a program, and memory block switching otherwise.

However, there are several disadvantages to this technique. The most obvious is the time required to transfer the program spaces to and from secondary storage. This problem can be lessened by using drums or large auxiliary memory for swap devices (they tend to be much faster than disks), or by hardware techniques (such as memory block switching) which avoid actual data transfers.

Another disadvantage is that much of the material transferred to or from the secondary storage may be superfluous, as programs almost never modify large amounts of storage in short periods of time.

A partial swapping technique is called *partitioning*. In this case, all of non-oper-

ating-system memory is logically divided into fixed-length pages. Only enough pages are swapped out to make room for new pages. Sometimes the hardware indicates whether a given page has been modified since it was swapped in, in which case it need not be swapped out.

The two major types of main memory allocation techniques are termed *contiguous* and *block*. The amount of memory requested of the operating system in a single call is often called a *segment*, and the hardware unit for memory allocation is a *page*, which may be of fixed or variable length.

*"The main memory
is never large enough
to satisfy all demands."*

In contiguous allocation, a segment is allocated on a page with size not less than the requested length. The allocated memory is a single contiguous address range. In block allocation, a segment is allocated to some number of pages, not necessarily contiguous. Then either the requesting task or the hardware must handle the non-contiguous nature of the allocation.

The basic problem in any dynamic memory allocation scheme is that the sequence of allocation requests almost never matches the sequence of de-allocation requests, leading to the problem of where to place a new segment when space for it is requested.

A method used on early large systems was to allocate memory at progressively higher addresses from the previous allocation and to de-allocate memory by compressing all higher allocations toward lower addresses. This method works only on hardware supporting position-independent program and data storage.

A form of memory protection often used on minis and micros requires no special protection hardware — the application programs simply cannot address other tasks' memory areas. Parts of the operating system and other systems programs may not be protected from access and modification by application programs, nor are program and data areas necessarily separate to protect an application program from destroying its own instructions. Some systems allow sharing across tasks on a read-only or execute-only basis.

Other forms of protection have been

used on mainframes. A common one is an address base-and-limit register pair or a base-and-length register pair. This idea provides position-independent program and data storage and prohibits accesses outside of the designated area. However, it totally prohibits any sharing among programs and does not protect a program from modifying its own instructions.

Secondary Storage Management

Secondary storage refers to all devices beyond main system memory that store information. All general-purpose computer systems have some form of secondary storage, and larger ones usually have several types of secondary storage.

Secondary storage methods include the following devices: bubble; cartridge tape; cassette tape; disk; drum; semiconductor memory; or tape. The disk devices support relatively fast, reusable storage and retrieval of large amounts of information. I didn't include cards, terminals, printer, paper tape, and communication devices in the list, since they do not provide reusable storage and retrieval of information. Other, newer devices, such as video disk, may be added to future lists.

Secondary storage devices can be categorized according to the following design or economic factors:

- Access mode — The order in which records are stored on and retrieved from a device. Usually, this is sequential or random.
- Capacity — The maximum number of bytes that can be stored on a device.
- Cost — The cost of the device itself and any media you need to use the device (tapes or disks).
- Data transfer rate — The speed at which data is transferred to and from a device. It is usually expressed in bits, bytes, or words per second.
- Latency time — The time delay between the instant the I/O request is received by the device until the instant the first byte is ready for transfer to or from the device. This delay normally has mechanical components, such as time needed for motor start-up or arm movement, and may also have physical components, such as rotational delays.
- Peculiarities — Particular methods in which a device must or must not be used, including physical parameters of devices, such as timing restrictions or number of tracks.
- Permanence — Whether data in a storage device remains when power is removed.

- Physical record size limits — The number of bytes in the largest and in the smallest group of information which may be stored on and retrieved from a device. If the low and high limits are the same, the recording mode is called fixed-length, and, if they are not the same, the recording mode is called variable-length.

- Removeability — Whether the media can be removed from the recording device, stored separately from the system, and replaced with additional media. Removeability increases the amount of potential storage space, but also complicates the operating system interfaces.

The ideal secondary storage device would be one in which the hardware imposes no unwanted structure on the IOCS attempting to use it. Of course, no storage device is ideal. However, many IOCSs use a virtual file interface, especially for random-access files, which acts as if the mass-storage device has no special structure. In this case, each device driver in the IOCS is responsible for interfacing this virtual file structure to the real file structure and device parameters.

The secondary storage management portion of an operating system is usually large and important. Within the category of secondary storage devices, the random-access devices (especially disk devices) are of special interest on most systems, since they are readily available and inexpensive.

Most secondary storage devices, and all major random-access devices, impose some structure in addition to the structure already present. In the classical file structure, a device holds at least one physical or logical volume of media (a disk, for example) containing at least one file. The file is a related collection of records, which are composed of fields, each of which is an adjacent group of bytes.

Many secondary storage devices, especially those with removeable media such as floppy disks, require the IOCS to automatically identify the contents of the disk.

Labels identify the volume and provide additional information, such as the time and date of creation and optional device parameters, such as capacity and density. Some IOCSs provide file security by recording and checking passwords in the volume label. They prevent accidental overwriting by recording and checking expiration dates.

For devices such as disks and tapes, the volume label is often recorded at a standard density. Most versions of Flex and OS/9 record track zero of all disks in single-sided, single-density mode for just this purpose. They both term it the "system identification record." Certain ver-

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sions of OS/9, such as the one for the Color Computer, do not follow this practice, and are not able to directly process disks intended for other versions of OS/9.

Virtual disks have become a useful way to *speed up operation* by letting memory simulate disk devices. In this case the entire memory device may be used by application programs, not only by the operating system.

For random-access devices, such as disk drives, the list of file names (often called a catalog or directory) must contain the starting position of each file. It may also hold additional information about each file.

Here's a quick summary of file-name rules for several operating systems — you'll notice a tremendous variation among systems.

- Color-DOS — Non-hierarchical, file name of one to eight characters starting with a letter, optionally followed by a period or slash and a three-character suffix, and optionally followed by a colon and a drive number (zero to three).

- CP/M — Non-hierarchical, file name of one to eight characters starting with a letter, optionally followed by a period and a three-character suffix and optionally preceded by a drive letter (A to D) and a colon.

- Flex — Non-hierarchical, file name of one to eight characters starting with a letter, optionally followed by a period and a three-character suffix and optionally preceded by a drive number (zero to three) and a period.

- MVS — Hierarchical within volume, each segment of path of one to eight characters starting with a letter, with path segments separated by periods and total name length of one to 44 characters; device type provided by catalog or UNIT= parameter; volume name provided by catalog or VOLUME= parameter.

- OS/9 — Tree-structured, each segment of path of one to 29 characters starting with a letter, with path segments separated by slashes; first full path segment name must be device name.

- Uniflex — Hierarchical, each segment of path of one to 30 characters starting with a letter, with path segments separated by slashes; first full path segment name must be device directory name.

- Unix — Hierarchical, each segment of path of one to 14 characters starting with a letter, with path segments separated by slashes; first full path segment name must be device directory name.

Storage problems on random-access devices are only vaguely similar to those

of main memory management. Because of their size (or potential size) and structure, random-access devices are normally allocated not by byte, but at a higher level: sectors, groups of sectors, tracks, or cylinders. As the minimum allocation unit becomes larger, the allocation process becomes faster, but the potential wasted space also becomes larger.

The random-access file structures used by various operating systems differ widely. There are normally only two primitive file access modes: sequential and random. However, there are several basic structures based on the primitive file modes, and there are several major file structures built from the basic structures on larger systems. There are even variations at the lowest level, in terms of logical and phys-

ical record lengths supported, or the method of determining the successor of a given record when accessing a file sequentially.

Indexes were introduced to support higher-level file structures. An index provides indirect information about the contents of a file with random-access mode. Indices may themselves be files or portions of other files, so indices may point to other indices.

A common application of indices is to an indexed-sequential file structure. Record keys and pointers let you access the file sequentially by following the index links or randomly by searching the indices. Alternate indices can provide file sequences by other than the primary key, without modifying the original file.

Next: Color systems. ■ ■ ■

Generations of Systems

The Eniac was the first full-scale electronic digital computer. Although it was initially designed to calculate ballistic tables during World War II, it was not completed until 1946. It was designed as a programmable calculator, with no internal program storage.

It had 20 ten-digit complementary accumulators and three function tables each of 104 12-digit signed numbers. Punched cards were used for input, output, and temporary storage.

The Eniac could add two numbers in 200 microseconds and multiply two numbers in 3000 microseconds. This sounds slow, but it was 500 times faster than the next fastest digital computer of that time. Other contemporary computers were based on relay logic; many well-respected electrical engineers insisted the Eniac would never operate long enough without error to perform useful work.

Programs were initially wired into boards, becoming a temporary part of the machine's structure. During 1947, Dr. Von Neumann of Princeton University suggested a modification to the function table hardware that would change the Eniac into a primitive stored-program computer. This modification was installed and running by late 1948. It slowed the computer's internal operation, but it made programming so much easier that the old method (wiring boards)

was never used again. The Eniac was used until it was permanently decommissioned and disassembled in late 1955.

First-Generation Mainframes

Until 1959, digital computers relied on strictly sequential instruction execution, including input/output operations, which themselves were instructions. Vacuum tubes were the main logic unit.

Programmers worked at a console attached to the machine, loading paper tapes or decks of cards into the reader, setting registers, single-stepping programs with the registers, and interacting with the computer at the lowest levels. Programs were then written in absolute binary machine code. They were usually preceded by a loader which placed them into storage locations.

Programming aids were primitive. Eventually simple assemblers, interpreters, and much later, compilers were developed, but these methods were so cumbersome and time-consuming that experienced programmers spurned them in favor of binary, octal, or decimal machine code. Program changes were made in absolute machine code.

Organizations that required programmers to use and maintain pro-

grams in a form other than machine code found the programmers could no longer run the machines themselves. Specially-trained operators followed intricate procedures to successfully assemble or compile programs into machine code. The programmers could no longer debug their own programs, since the machine code produced by the interpreters and compilers did not correspond directly to the symbolic representation of the program.

The first generation of operating systems was developed to standardize input/output libraries and procedures, and to simplify the process of loading and executing assemblers, interpreters, compilers, and user programs.

Early operating systems were little more than *batch loaders*. After the operating system was loaded, the operator loaded decks of cards that held a user's programs and data. The operator then entered the name of the system program needed to process the program, or selected decks of cards representing the system programs. All along, the operator monitored the program to ensure it did not use too much time, paper, or cards. After each program, he gathered the decks and print-outs, and proceeded to the next deck.

Operating systems eventually became more independent — they could read control cards from program decks, eliminating the possibility the operator might hit the wrong key when requesting the operating system to process a deck. Unfortunately, the operating system remained unprotected from runaway programs, and an operator still had to monitor the progress of each program.

A major step during this period was the development of time-sharing operating systems. These were usually little more than multiple-user language interpreters. A few teletypes or other low-speed printing terminals were attached to the computer system. The facilities were primitive — each user only gained the power of a programmable calculator, at a very high cost. However, time-sharing systems brought the power of a computer directly into the laboratory for the first time, and allowed more than one user access to the machine at the same time.

The best part of time-sharing operating systems, as far as the users were concerned, was that the interpreter

provided meaningful diagnostics. As far as computer center management was concerned, the interpreter protected the operating system from runaway programs.

Second-Generation Mainframes

The second generation of computers occurred from about 1959 until about 1963. Transistors replaced vacuum tubes, so computer systems became smaller, ran cooler and more reliably, and had a much greater capacity. The systems also became more complex.

Fortran became the common language. IBM, the dominant force in the mainframe market, included Fortran in all its computers.

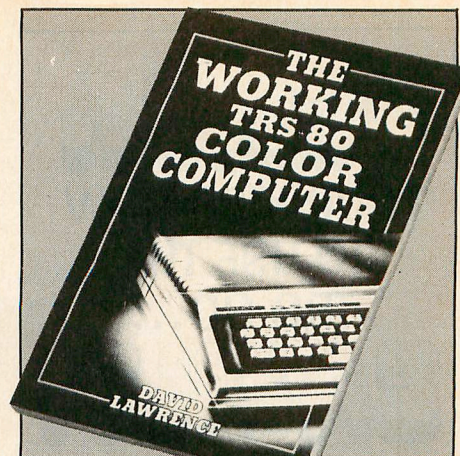
Fortran was normally used with an operating system that provided a standard library and some error handling. Universities extended these basic operating systems to facilitate batched operation, in which the Fortran compiler was resident. A series of small programs processed through it.

Batched operating systems simplified computer operation and vastly increased program turnaround time. Entire batches of programs were placed on magnetic tapes, the tapes were processed, the output was placed on tapes for printing, and the individual print-outs were decollated and distributed.

The most important hardware development during this period was the *data channel*, a hard-wired computer that controlled some communication between the CPU and memory and peripheral devices. When a data channel received a request from the CPU, it executed and controlled the operation asynchronously and independently of CPU operations, with as much overlap as possible, fetching and storing channel commands and data to and from main memory by stealing memory cycles from the CPU. It then reported its completion status by interrupting the CPU.

Complicated input-output routines were required to control these channels properly. The average programmer could no longer write input-output code and expect it to function properly. Reasonably sophisticated operating systems were developed to take advantage of the capabilities of data channels.

The concept of *interrupt* was extended to include conditions such as



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arithmetic overflow and underflow, processing too long, and system calls. However, memory protection was not normally available, and system crashes caused by program or system error were common and hard to trace.

Program libraries became more sophisticated. Sort generators and peripheral copy programs became commonplace and were often considered part of the operating system, as were additional language processors. Direct-access devices replaced magnetic tape as storage. Traffic to the direct-access devices was normally sent through the operating system; volume directories and access methods were developed to help the operating system control these devices.

Third-Generation Mainframes

From 1962 until 1969 multiprogramming established itself securely on large mainframes, and time-sharing remote access displaced batch access. Large, fast, direct-access disk devices provided on-line storage for operating systems, application programs, and application data files. Integrated circuits reduced the computer's size, complexity, and power requirements, and increased speed and capacity.

Memory protection hardware and the software to control it supported the multiprogramming environment. Most mainframes had a special set of instructions for input-output operations and for controlling the memory protection hardware. This set of instructions was almost always restricted to execution by the operating system to control accidental or malicious misuse of the computer system. Sophisticated internal accounting systems tracked computer use by each operator.

Hardware memory relocation schemes appeared on more sophisticated systems, allowing *dynamic* or *virtual* memory systems in which the amount of memory attached to a system can greatly exceed the addressing capacity of the CPU. Multiprocessor systems also became more common, requiring enormously complicated operating systems.

IBM's all-encompassing OS/360 became the most common operating system for large mainframes, and its descendants remain popular to this day. OS/360 never supported virtual memory or multiprocessing, but it did support multiprogramming and mul-

titasking on IBM 360 hardware.

Towards the end of this generation, operating systems were recognized as a central part of new computer systems, and thus a central part of software engineering and computer science. E.W. Dijkstra published a series of articles from 1965 to 1969 codifying the theory of concurrent processing control. Dijkstra is better known for a 1968 letter to the editor of the *Communications of the ACM*. He criticized the use of GOTO statements as bad practice, and said they made programs in general impossible to mathematically prove correct.

Fourth-Generation Mainframes

After 1969, Large Scale Integration (LSI) and then Very Large Scale Integration (VLSI) replaced the simpler integrated circuits. Mainframes then shrank in size and power requirements, and grew in speed and internal and external capacity.

Vast, relatively inexpensive, fast, direct-access disk drives with capacities of hundreds of millions or billions of bytes became available. It became practical for many large data files to be available as database files, establishing the usefulness of on-line systems.

IBM finally embraced virtual memory and multiprocessing, and made them integral parts of its hardware and software. IBM also continued to increase the real main memory available. The original limits were almost all far below the architectural maximum of 16 million bytes. Several of the larger CPUs were made capable of the maximum amount, but when the demand for even larger address spaces became great enough, IBM announced XA (extended architecture) with architectural limits of about a billion bytes of main memory.

One major advance of this period is the ability to extend a mainframe's power to remote sites. IBM's products are designed according to an overall plan, called Systems Network Architecture (SNA). SNA will eventually replace all individual communications protocols. IBM has integrated SNA into its operating systems so well that a user at a terminal attached to one computer system may be using programs and data on several other major computer systems without being aware of the fact.

■ ■ ■



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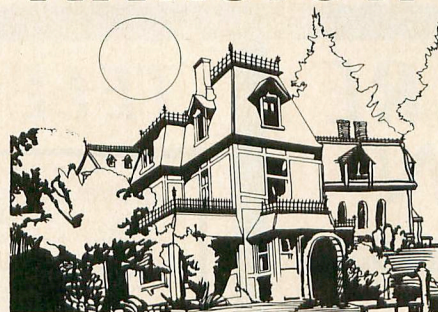
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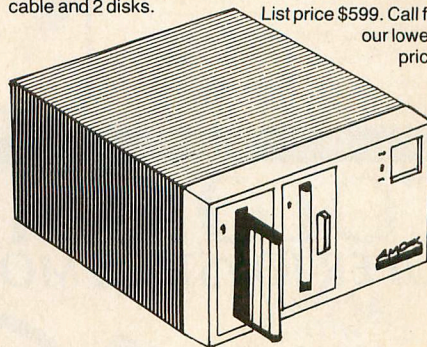
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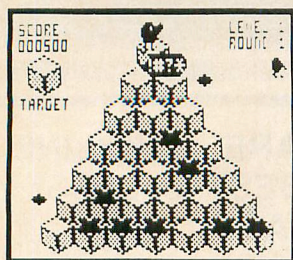
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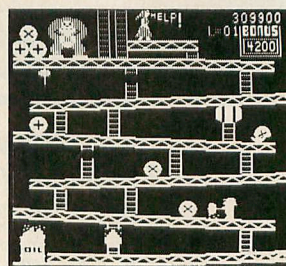
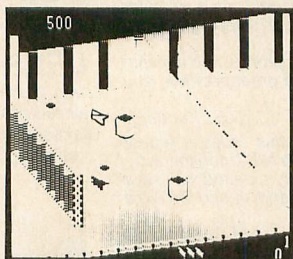


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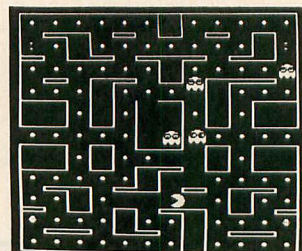


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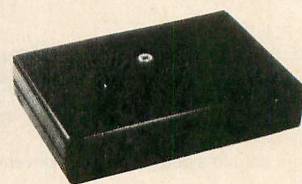
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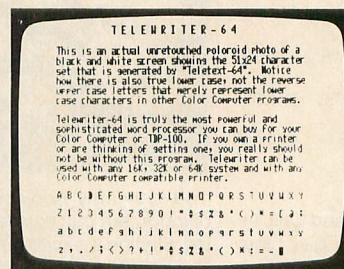


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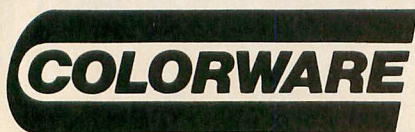
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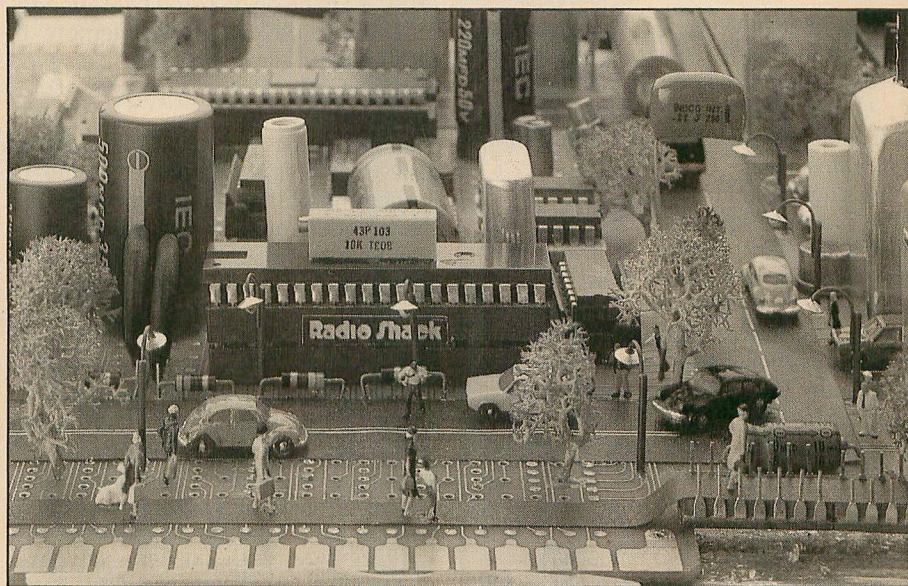
GRUNBY GREET'S CP/M

CP/M, ONE OF THE GRANDADDIES of microcomputer operating systems, is here. Why, you may ask, do we need another operating system? Because CP/M has given rise to a wealth of commercial and public domain software over the years, and estimates of the number of available software packages range from 5000 to 15,000. That's why.

The acronym "CP/M" means different things to different people. Many computerists believe it stands for "control program monitor." Others say it stands for "computer programs for microprocessors." According to Digital Research Inc., the Silicon Valley firm that originally wrote CP/M, it means "control program microprocessor."

Like all disk operating systems, CP/M simplifies computer use and improves productivity. Service functions for the management of disk files and establishment of application programs are provided. For uniformity's and compatibility's sake, the CoCo Coupler, which is licensed by Digital Research, preserves CP/M's standards and conventions. The best way to appreciate what Wayne Technology (from here on, let's just call the company "Wayne") has done is to become familiar with CP/M's background.

Back when the 8080 and eight-bit Z-80 micros were sweeping the data processing world is when CP/M came out, and it's on those chips, and their relatives, that CP/M is based. During the same era the eight-inch floppy disk became commonplace for random access, removable storage. Digital recognized the value of that medium and kept disk functions in mind during the design of CP/M. Many characteristics of CP/M have remained virtually unchanged over the years. Modernization of CP/M operating system concepts are in progress but changes are evolutionary, not revolutionary. Generally, later versions will accept software developed under earlier versions. There



CP/M reported to open the Color Computer to entry and use of visitors from other micro worlds.

is, of course, a constant struggle between compatibility and innovation. Different versions of CP/M exist because they acknowledge different chips. Originally, CP/M used the single-sided, single-density, eight-inch floppy disk as a standard device type. Even though this is still the standard recognized by CP/M for removable storage, 5-1/4 inch disks are now more common. The CoCo Coupler 1 stores information on 35, 40 and 80 track 5-1/4 inch disks.

Most screens display 80 columns and 24 rows. These customary dimensions are usually expected by CP/M applications. Yet some displays are not as great, as Color Computerists know, but Wayne's taken that into account and has incorporated the larger display.

CoCo Coupler

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NEW COLOR OUTLOOK

The CoCo Coupler 1 contains a four-megahertz Z80A microcomputer chip in an adapter that plugs into the cartridge port. The adapter is housed in a trim, black, anodized aluminum case that also functions as a radio frequency shield. The edge connector on the cartridge port is gold-plated for reliability. Since use of the adapter requires removal of the disk controller, another connector for the controller has been provided on the opposite end of the adaptor case. The overall length of this combination is about 10 1/2-inches.

Stability is ensured by an L-bracket beneath the unit. Wayne has a 90-day warranty on the adaptor and will replace master disks that have been damaged in shipment.

With the adapter installed, your Color Computer will show you a new side. The menu asks whether to boot up with CP/M or Basic. When in the CP/M mode a boot routine in the adapter will load CP/M from a disk in Drive 0. When in Basic

all customary functions of the Radio Shack Disk Extended Basic operating system are there just as though the adapter was not connected. You can boot Flex or OS/9. While using Flex and OS/9, the only noticeable new behavior is that hitting the Reset button will make you go back through the master menu instead of boot-up.

SOFTWARE ON DISK

Software for CP/M 2.2, the version of CP/M in the CoCo Coupler 1, is supplied on disk. The disk contains a loader for the operating system, a memory image of the operating system, and a set of utility programs.

To understand how Digital Research's and Wayne's software work together, first understand the events that lead to the execution of the text editor.

After the selection of CP/M from the menu, the loader completes the bootstrap operation begun by the Coupler. The loader has no function other than to read sectors from track 0 and 1, where the image of the operating system resides, and to store this information (instructions and data) into memory. It then transfers control to CP/M. Next, CP/M performs whatever I/O initialization is necessary and puts the A> prompt on the screen. This prompt means drive A (Drive 0) will be used for all implied references to a drive and that CP/M is awaiting command input from the console. The command for calling the text editor is ED. After it's entered, it is examined for validity by a console command processor and loaded. Since the text editor resides on disk, the command processor must find it in drive A under the file name ED.COM and arrange for it to be loaded into memory. ED is then given control and asks for the first line of input.

The text editor sequence uses a bootstrap loader and elements of CP/M. The loader and all software elements designed explicitly for the Color Computer are products of Wayne Technology, as all elements of CP/M independent of the particular computer they run on are products of Digital Research. The following list identifies the origin of these software modules and summarizes the functions of each.

- The bootstrap loader uses the disk controller to read CP/M from Drive A.
- The console command processor (CCP) is independent of the computer type. It is active when CP/M is waiting for command information. The com-

mand line is examined for proper format and decomposed into fields for interpretation. The CCP also contains a number of built-in commands: <drive name>: changes the default drive to A, B, C, or D; DIR gives a directory of file names; ERA erases a file(s); REN renames a file; TYPE displays file contents; SAVE names a block of memory and transfers it to a file; and USER changes an implied numeric prefix to a file to partition a directory.

All other commands, (such as ED) are expected to be on disk. The CCP arranges for these to be loaded into memory. In fact, CCP will allow itself to be overlayed since the new command is given complete control.

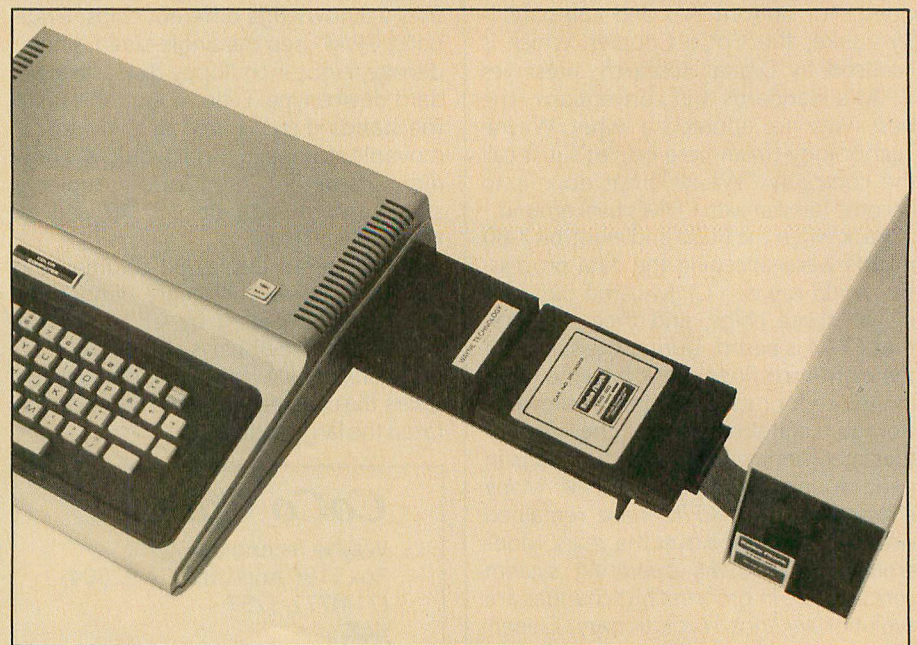
- The Basic Input/Output Systems (BIOS) contains the logic and software for communications between CP/M and the outside world. BIOS has been carefully tailored for Color Computer hardware. It addresses the serial I/O port, disk controller, keyboard, and the screen. It implements important details like I/O timing, error recovery, and device status.

- The Basic Disk Operating System (BDOS) is the common interface to the applications programs and utilities. BDOS contains over 40 service functions, functions for transferring bytes or records to or from an I/O device, functions to manipulate file directories, and management services. When BDOS must obtain data from a specific device, it calls on BIOS to accomplish the actual transfer. In this way, BDOS is independent of particular hardware — in our case, the Color Computer.

These software elements occupy memory at locations that were pre-defined by Digital Research. These address definitions are collectively called a memory map. Applications that run under CP/M 2.2, and previous versions, expect to find the same memory map regardless of the computer system. An application written for another computer can generally be run on the Color Computer because these address conventions have been followed.

There are two other areas in the memory map, the Transient Program Area (TPA) and Page 0. The TPA is where all application programs and utilities execute. Page 0 contain assembly language instructions and data for the operating system's own purposes. From low-numbered memory locations to the top of memory, the areas in sequence are Page 0, the TPA (which is where the CCP actually resides), the Basic Disk Operating System, and the Basic Input/Output System. Since the CCP is not required once a program is executing, its space is considered free for use and may be overlayed. After execution the CCP is restored.

Digital Research also provides transient, as opposed to built-in, commands that are on the Wayne disk. ASM is the assembler for the 8080 and the Z80A. DDT, the Dynamic Debugging Tool, tests, changes, and diagnoses machine code programs. DUMP displays the contents of a disk file in hexadecimal format. ED is the standard line editor for CP/M. LOAD converts an ASM file for use as a transient command. PIP, the Peripheral



Wayne's CP/M plugs into the ROMpak port.

Interchange Program, moves files from one medium to another. STAT provides status information about devices and allows changes to read/write protection attributes. SUBMIT gets command line calls from a file instead of the keyboard. SYSGEN places a copy of CP/M onto a new disk to make it a system disk. XSUB selects a file, rather than the keyboard, as input to an executing program.

Six utilities and two features have also been specially written for the Color Computer. Each interacts with CP/M to provide services that depend on the Color Computer environment.

- Setup controls the use of lowercase and allows selection of the rate at which characters are sent to the printer. Both uppercase-only mode and shifting of the character case with the shift key are allowed. The baud may be changed to anywhere from 110 to 9600 bits per second.

- Video80 formats the screen for 80 columns by 24 rows. Much CP/M software expects 80-column capability, but Video80 does not actually produce 80 columns, nor does it produce true lowercase characters. Without it the default size of the screen is the old 32 columns by 16 rows, complete with wrap-around. Video80 uses this size as a window view within the larger logical display. Control keys shift the actual view within the larger display. A Clear/Up-Arrow keystroke positions the window to the top left sixteen lines. A Clear/Down-Arrow keystroke shows the bottom left sixteen lines. Clear/Right-Arrow shifts the window horizontally. Depressing any letter key positions the window back to the top left sixteen lines, restores the cursor to its original position, and lets the CCP process input. If CP/M is presenting a stream of lines, horizontal scrolling will take place automatically when needed. Every time a line exceeds 32 columns, Video80 shifts the window view to the right so the extended columns are displayed as they are generated. The screen scrolls from top to bottom, from left to right, and back again; the display is positively dazzling.

- Wordpak is a commercial (PBJ, Inc.) program for a particular hardware cartridge that offers a full 80-column by 24-row display, true lowercase, and inverse video. To use it, you'll need a multipak interface. (Wayne has run successful tests using a Y-cable to bypass the need for the interface, but warns that doing so yourself exceeds specifications.) This Wordpak utility implements the display that is expected by much existing CP/M

software and, in effect, places the Color Computer squarely in competition with computers built solely for serious applications.

- Config specifies or changes the configuration of disk drives. It tells CP/M to recognize Radio Shack's 35 tracks or the 40- and 80-track formats available on competing drives. Config also is used to select the printer baud and voltage polarity.

- Transfer is a communications program that is designed for a 300 baud modem (and, of course, a telephone). It is not designed for interactive communications since none of the characters it receives are echoed to the screen. It allows only the transfer of files between two computer systems. As such, a little voice coordination must be used to ensure that both Transfer and the remote computer are ready before data is sent. Transfer expects a format of eight data bits and no parity bit. It is compatible with the protocol of the public domain software package called Modem.

- For all screen formats, CP/M 2.2 features controls that emulate the functions of the commonly-used Lear Siegler ADM-3A terminal. The ADM-3A functions position the cursor about the screen, and clear it. The Clear key serves as the CP/M control key, and Shift/Up-Arrow is the escape key. Only those packages that recognize ADM-3A controls will work with Wayne's CP/M.

- The Phantom drive feature, as its name suggests, indicates that an extra drive is simulated by the operating system. More correctly, it uses memory as a temporary exchange medium to copy files between disks. On a system with one drive this is the only way to transfer files or to back up a disk. Using Phantom requires endurance. Source and destination disks must be alternately placed in the drive until all sectors have been transferred.

The Coupler comes with version 1.1 of the user's manual published in December, 1983. It's only 22 pages long and, unfortunately, could be a lot better. While a comprehensive manual would have substantially upped the product's price, the cost cutting measure has resulted in documentation that offers only the briefest of explanations. The Digital Research manual itself is 250 pages long, but copyright costs prevented Wayne from incorporating it, Wayne says. Users can turn to Digital Research or other sources for documentation needs. Osborne/McGraw Hill, at 2600 Tenth Street, Berkeley, CA 94710, is one such source.



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Software Compatibility A Consideration

To run on the Color Computer, any software package will have to conform to a few conditions. First off, if it isn't obtained by communications circuits; it must come on a 5¼-inch disk. Traditionally, public domain software was distributed on 8-inch disks, so not all free software is available on the now-common 5¼-inch disks. (The official, standard CP/M medium remains the 8-inch disk.)

Disks must also be format-defined for the Radio Shack Model I, which is the same as the Omikron format. The CP/M Users Group in New York City sells a catalog of public domain software and will reproduce and mail almost 100 disks of software at a nominal cost. The formats that group produces are 8-inch IBM, North Star/Apple, Kaypro II, and Epson QX-10, not the Omikron format. Software for purchase from commercial sources is generally found in many different 5¼ formats and may include the single-density Omikron format.

Software must, of course, be able to run under CP/M 2.2. It also must fit in the 56K long Transient Program Area. If it depends on screen control functions, it must be able to use ADM-3A functions that have been emulated on the Color Computer.

Some software requires a minimum amount of disk storage space. On a 35-track drive the single-density Omikron format has a capacity of 80K. With space taken for directory information about 70K remains. Capacities of over 160K are common today, and many powerful software packages depend on such greater capacities.

This condition was perhaps the most serious limitation of the Coupler, since it originally came with single-density only. Now, however, it comes with double-density, which gives you 115K.

(Ed.'s note: Another Wayne product called Multiform, which was not reviewed, lets you read and write a dozen disk formats, including those made by Radio Shack, Xerox, Kaypro, Heath, Lobo, Osborne, Morrow, and Zenith.)

The acid test of compatibility is to see how commercial software works. If you're going to buy software, read a description of the expected environment, talk with a sales person, or negotiate a return policy in advance. I tried a Lifeboat Associates full screen editor and a combination word processing, spreadsheet, graphics,

and list processing program. They all worked fine.

My experiences with the Coupler were virtually trouble free. I did find some inconveniences in Wayne software that are potentially troublesome. One problem is that I couldn't use my printer at 9600 baud. This problem is not unique to Wayne Technology, however; I've had a similar problem with OS/9 but have been able to correct it with a patch. Timing loops that transmit bits to the serial port are critical at that speed and should be adjustable, but the Config utility does not allow any fine tuning to the timing controls. It only permits the specification of an index number to represent the baud. Some instruction on making patches to printer constants or loops would be a reasonable stop-gap solution.

There were also occasions when I preferred the 32-column by 16-row format to the Video80 format. During vertical scrolling you can read an entire line as it flashes by even though it may wrap around to the next line. I found Video80's dynamic horizontal scrolling disconcerting when it occurred during vertical scroll operations. The only way to change from Video80 to the default format is via a cold boot of CP/M with the Reset button.

My most serious reservation about this version of CP/M regards using it with only one drive. The Phantom drive feature allows disk-to-disk copies with a single drive but that demands patience, a commodity often in short supply. As a test, I used the Phantom drive to copy the system disk to another. Although a prompt was displayed each time a disk had to be swapped, there was no information about when to load the source or target disk. According to Wayne, if you choose the wrong disk you simply lose the transfer and get an error message. After more than 15 swaps, I just abandoned the test.

It's reasonable to seriously consider adding CP/M to your system. Compared with the cost of a new CP/M computer, the cost — and abilities — of the CoCo Coupler 1 are more than acceptable.

— Eugene Grunby

(Ed.'s last note: Color Power Unlimited's Color Power II is the CP/M unit competing with Wayne's. We would like to have reviewed them both but Color Power wasn't yet ready with its product. We will review it as soon as possible.)



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DISK ENCOUNTERS

Make your DOS a new experience.

Part One

by Doug Kelley

DECB2 IS DESIGNED TO ADD several new features which I thought would come in handy while programming with the Basic interpreter. As it turns out, the modifications are useful for the non-programmer as well.

Any Color Computer with 64K of memory and at least one disk drive with Disk Basic 1.0 can use this program. Once the program has been run, it uses no memory except for some in the upper 32K, the area Basic doesn't access. When the program is run, it copies Basic from ROM into RAM, without destroying any Basic program which may be in low memory. Next, DECB2 will rewrite some of the sections of the interpreter, and then return to Basic with a new sign-on message.

The first sections of code modified are the DSKI\$, DSK0\$, BACKUP, and DSKINI. After the program is finished, you will be able to read and write to track 35 on the disk using the DSKI\$ and DSK0\$ commands. BACKUP will copy all 36 tracks and DSKINI will format all 36. Two uses for the 36th track are: storing a back-up directory; and writing data there to help make a program uncopyable. Be sure to only write to the 36th track if the disk has been formatted for 36 tracks, otherwise an INPUT OUTPUT (not IO) Error message will appear.

Surprise!

No longer will you have to put up with ambiguous error messages as BS ERROR, and my favorite: NO ERROR. Instead you will be greeted with BAD SUBSCRIPT ERROR and NOT OPEN ERROR. Even the undocumented UNDEFINED FUNCTION ERROR has been included.

Next on the program's agenda is the enabling of an automatic key repeat function. If any key is pressed for more than half a second, it will repeat. For those of you who are interested, this function works from the computer's 60Hz interrupt, so some sound effects may be slightly distorted due to the longer delay every 1/60th of a second.

What's next? How about a *readable* display? It does modify the CHROUT routine in ROM to display green letters on a black background instead of the eye-fatiguing black on green. One drawback to this feature is that you no longer have inverse (black on green) video unless you use a Poke command to put the characters on the screen; to get a green screen, you will have to type CLS1. The advantage: with software, you don't have to void your warranty, or worry about blowing your SAM chip to get this option.

Finally, the computer makes some less-involved modifications. The Verify function is turned on automatically so

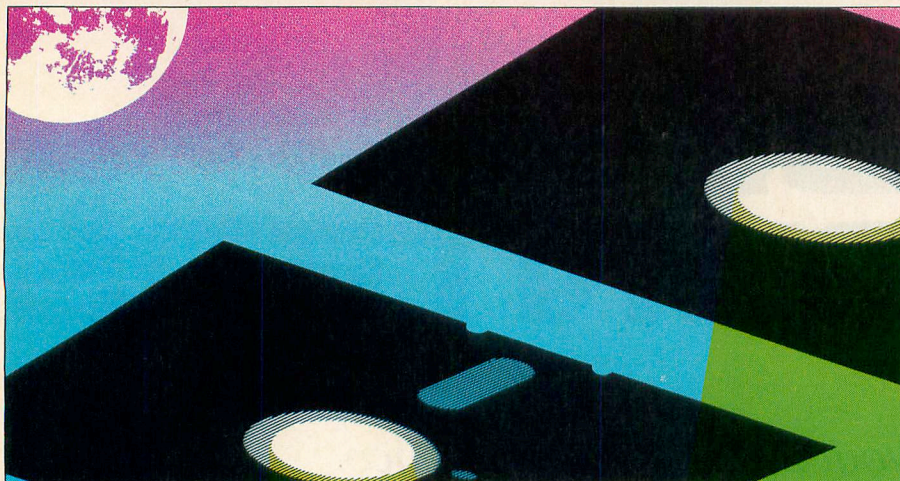
you don't have to do this manually. The disk drive is allowed to run longer after it has been accessed to allow the user more time to type in his next disk access command, reducing the number of disk motor starts and stops. Finally, the drive will only re-try one time after it gets an error, instead of grinding the head up and down the disk four times for any type of input/output error.

The Listings

I have provided two listings of DECB2. One is in Basic, the other in assembly language. Type in the Basic program, save it to disk, then Run it. I encourage those of you who know assembly language to type in the source code, and make any modifications you want as long as the first two lines remain the way they are. You will find the program fully commented and very easy to *modify*, *provided* you have a basic understanding of how the interpreter works.

I hope this program will be enjoyable and educational. I wish I could have made a 16K and 32K version, but most of the program has to modify the Basic interpreter directly in some way, and therefore, without 64K, the program would be almost impossible. ■ ■ ■

♦ Programs



TWO BUGS IN Disk Basic ROM 1.0 were not corrected in version 1.1. Let's fix them ourselves. I will describe the bugs, then give the source code for some corrections to Disk Basic 1.0 ROM that will also add some extra, useful features to your ROM.

Turning on your machine, or on cold start (POKE 113,0 Enter, then Reset) the Verify function is normally set to off. This can be a real nuisance, if you use the verify function all the time. Also, my printer is set to receive data into its buffer at 9600 baud, but Basic defaults to 600 baud. Remembering to set the baud for my printer system each time I use a different program, or to include a POKE 150,1 command (needed to set the baud to 9600) in everything I write, is not efficient.

Did you know that for years Model III owners have had the pleasure of turning their computer on, putting a disk in drive 0, and simply hitting Reset to have a program of their choice automatically loaded and executed? This is referred to as *booting* a system. It's a real convenience to frequent disk users. I thought that feature (an easily user-configureable boot routine) would be really nice to have on my Color Computer.

I have been using a Color Computer that can be configured to boot virtually any program on a disk using a one- or two-line Basic program. This boot is accomplished by holding down the space bar while Reset is pressed. To do this and make the other changes we mentioned, a few alterations need to be made to Disk Basic ROM. Since the ROM itself is inalterable, I dump the ROM to low RAM, alter the code there, then burn an EPROM with the altered code and substitute that EPROM for the original Disk Basic 1.0 ROM in the disk controller card. What is

surprising is that all the improvements are made using a 60 line assembly language program.

The "Head Banger Bug" is encountered every time you access your disk after turning your machine on or a cold start. You can detect it as that annoying "brrrrrap, brrrrrap" noise your drive makes before it finds the file or directory for the first time. The head of your disk drive is being banged repeatedly against the *inner stop* of the drive. (The inner stop prevents the head from moving off the disk and onto the center hub.) It is the result of sloppy coding, and is at the least annoying, and may actually shorten the life of your drives.

It happens because the Disk Basic software thinks your head is sitting at track zero. Unfortunately, this is seldom true. In fact, your head is wherever it was when you turned the system off... usually sitting poised over track 17. When the drive tries to find the directory track after a cold start, it goes careening inward, and only recovers its mistake after slamming itself against the inner stop. Microsoft has not corrected this flaw in its new release of Disk Basic 1.1. I hereby put the code to correct this in the public domain, and earnestly hope Tandy and Microsoft will make the needed correction in Disk Basic 1.2 if and when they write a second revision to the Disk Basic ROM.

The Head Banger bug is fixed in my patches to disk ROM by altering the initialization routine of the disk ROM so that on a cold start or a newly turned on machine, flags are set for each of four drives. When a drive is later accessed those flags are checked; if they show that the drive had not been previously accessed, the head is first reset to track zero before any other disk operation is performed. That same initialization routine

patch has added to it some code to reset the baud to your taste, and to turn the Verify function on.

The "Head Settle Bug" is an extraordinarily subtle bug that affects only owners of two-drive systems using solenoid equipped non-Tandy drives (for example, MPI's, Shugart's, Teac's, and Pertec's drives all have solenoids... TEC's, TPI's, and Tandon's do not). It manifests itself as the very infrequent destruction of a sector on a disk during the course of two-drive disk operations. It is caused by the failure of Microsoft's disk software to wait for the head of a drive to be lowered onto the disk by its solenoid, but is only a problem when a Write function is performed on one disk immediately following a Read or Write operation to another disk drive. Even in that case, the problem will arise only very occasionally, as in most cases the time it takes for the head to find its new position on the drive gives it time to settle. Only when you switch from one drive to write to another *and* the area you are trying to write to is just exactly where the head of that drive happens to be will a disk crash result.

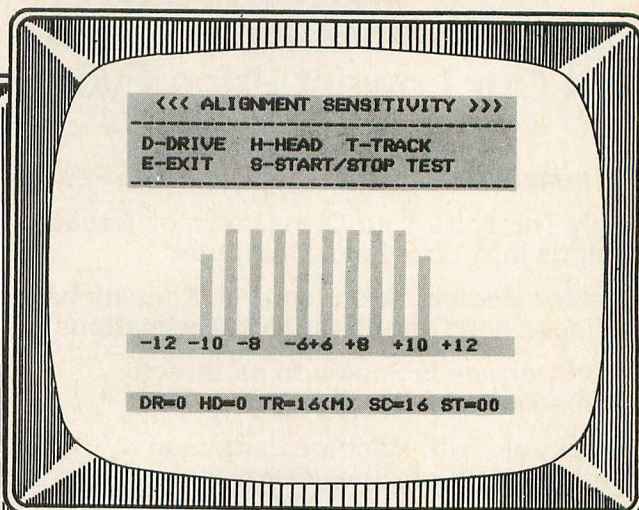
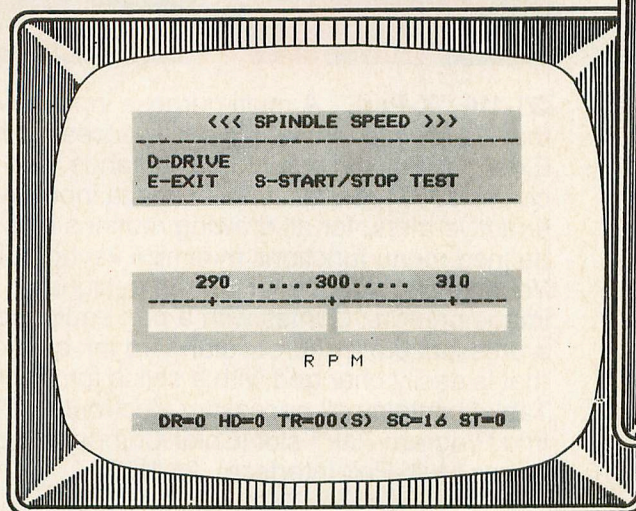
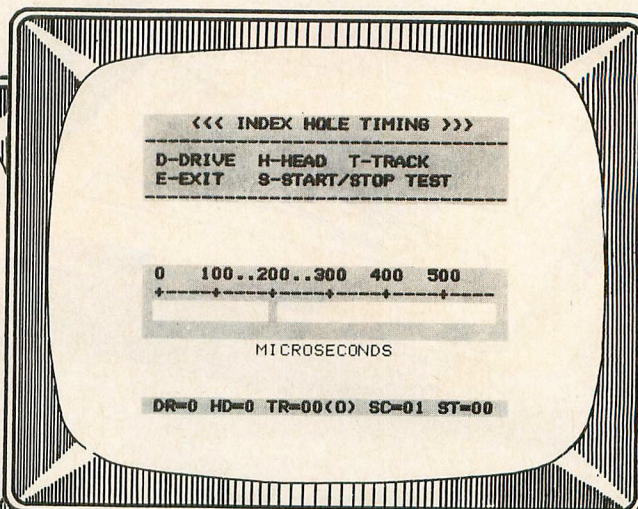
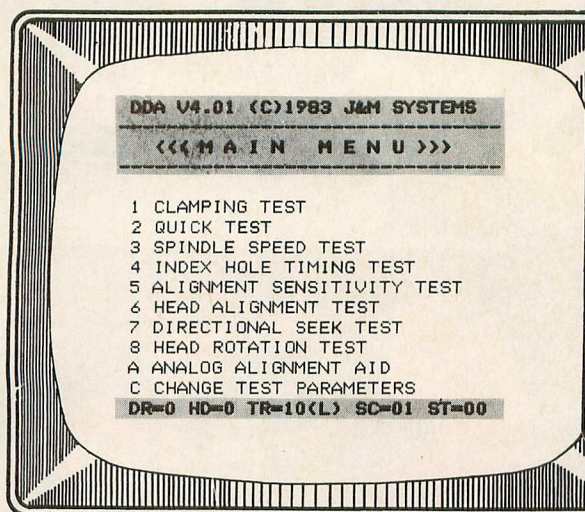
The Head Settle bug can be fixed by merely disabling the solenoids on solenoid operated drives. This is done by removing the HS (head select) jumper on the drive and jumpering the HM or the HL jumper (some drives call it "head load" and others call it "head motor"). But if you wish to use your solenoids, this patch to the ROM will let your drives be properly accessed. If you don't have solenoid equipped drives, this patch will not significantly affect the operation of your system. (At worst it will make some long two-drive copy procedures a few seconds slower over the course of many minutes of use).

The fix consists of a check to see if a switch has been made from one drive to another and, if so, the computer is forced to wait 80 ms before proceeding. Only a 30 ms or shorter wait is specified by most manufacturers of solenoid-equipped drives, but the 80 ms routine is conveniently already present in Basic. The extra 50 ms delay will not be noticeable in normal use.

The boot routine is started when the computer checks to see if the space bar is held down during the initialization sequence. If it is, Basic is fooled into thinking you just entered RUN "BOOT". The really nice thing about this way of booting the system (as opposed to the clumsy code Microsoft wrote into the disk 1.1 ROM as the DOS command) is that you,

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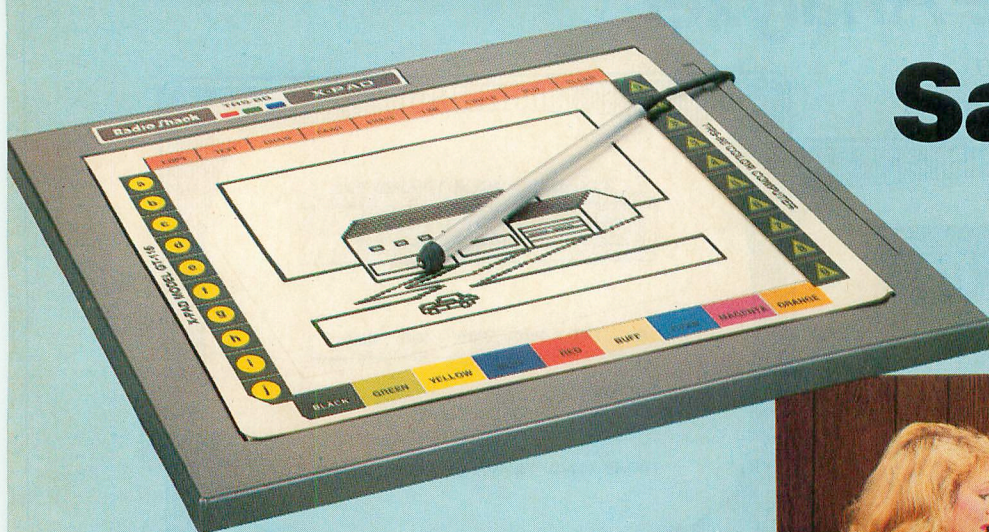
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the user, can configure the system to load and run any program you want with just a simple one- or two-line Basic program.

For example, if you want to make your Telewriter 64 disk boot, rename the program U/BAS to BOOT/BAS. That's all there is to it! Now, instead of entering RUN "U" you can merely insert your Telewriter disk in the drive and hit the Reset button while holding down the space bar. Should you happen to bring that disk to someone else's house and want to run it on their conventional disk ROM, you merely enter RUN "BOOT" and it will function normally. Thus, complete compatibility with non-booting systems is achieved.

To boot machine code files, you must type in a Basic loader program: 10 LOADM "filename/ext": POKE &HFF40,0:EXEC. The POKE will turn off the disk drive motor after loading the file and before executing it. Occasionally you will have to add to this simple routine a PCLEAR statement to get the Basic loader program out of the way of the machine code program you are loading. I leave this as an exercise for the reader: just remember that in default (PCLEAR 4) mode, Basic programs reside from \$2600 in memory on up. A machine code program that loads over that area will clobber your Basic loader. You've got to move the Basic program out of the way (either up or down in memory) using the PCLEAR statement. You must also take into account the PCLEAR bug (if you have a version 1.0 Extended Basic ROM), that forces you to put your PCLEAR statement at the end of your Basic program, and then jump to it at the start of the Basic program.

The Source Code

To use the program, first assemble it into a segmented binary object file. The constant "LORAM," set at the start of the program, is used to position the code to the block in low RAM you are going to move the original Disk Basic data to, prior to patching it and then burning an EPROM. Thus, as I moved the Disk Basic data to \$2000 through \$3FFF (this is the buffer area for the Intrinsics EPROM programmer), I set LORAM to \$2000. I also set the baud to 2400 by putting decimal 18 into location \$380B. You can cause your system to boot in any baud you like by substituting the requisite constant (1 for 9600 baud, 87 for 600 baud, etc.) in the assembly listing.

The source code was created on the Microworks Macro 80C Editor/Assembler, and uses one directive instruction with which users of other editor/assembler programs may be unfamiliar: the

REORG statement. This instruction tells Macro 80C's assembler to go back to the address sequence it was using just prior to the last ORG statement it acted on, increment it by one, and continue assembly at that address. In other words, it causes assembly to continue where it left off when the previous ORG statement nullified the ORG statement before it (resulting in a "nested ORG," sort of). A careful look at the addresses in the second column of the assembly listing will help you understand this instruction. (I certainly don't blame you if you find my verbal description a bit confusing... the function of that darn instruction is very hard to put in words!)

"Complete compatibility with non-booting systems is achieved."

The binary file you get is highly segmented, as it has to load in throughout Disk Basic ROM to insert its patches. After assembling the patches file I saved Disk Basic to disk (SAVEM "DBASIC", &HC000, &H0FFF, &HA027) then offset load Disk Basic to low RAM (LOADM "DBASIC", &H6000). I then superimposed the patches by loading my binary patch file from the disk (LOADM "PATCH/BIN") and saved the freshly created modified Disk Basic file to tape (CSAVEM "NEWDISK", &H2000, &H3FFF, &HA027). Next I turned the power off, removed my disk controller card, inserted an EPROM programmer into the Color Computer's system port, and turned the machine on. I then input the tape I had just made and burned a 68764 EPROM (this variety is pin-for-pin compatible with the ROM in the disk controller) with the data I had loaded into \$2000 through \$3FFF. That was that! One corrected disk EPROM cooked up to my specifications! All that remained was to open up my disk controller card, remove the disk ROM, and replace it with the EPROM I had just burned.

Cautions

The new EPROM will be 99 and 44/100ths percent compatible with existing disk software. In one month of extensive testing I have encountered only one program that would crash because of the patches. This was a program that, on execution, went into all RAM mode and proceeded to boot itself up to high RAM starting at location \$D800. This overwrote the patches and caused the system to crash when the program (a disk directory utility) accessed the disk. This program would also be incompatible with the new Disk Basic 1.1

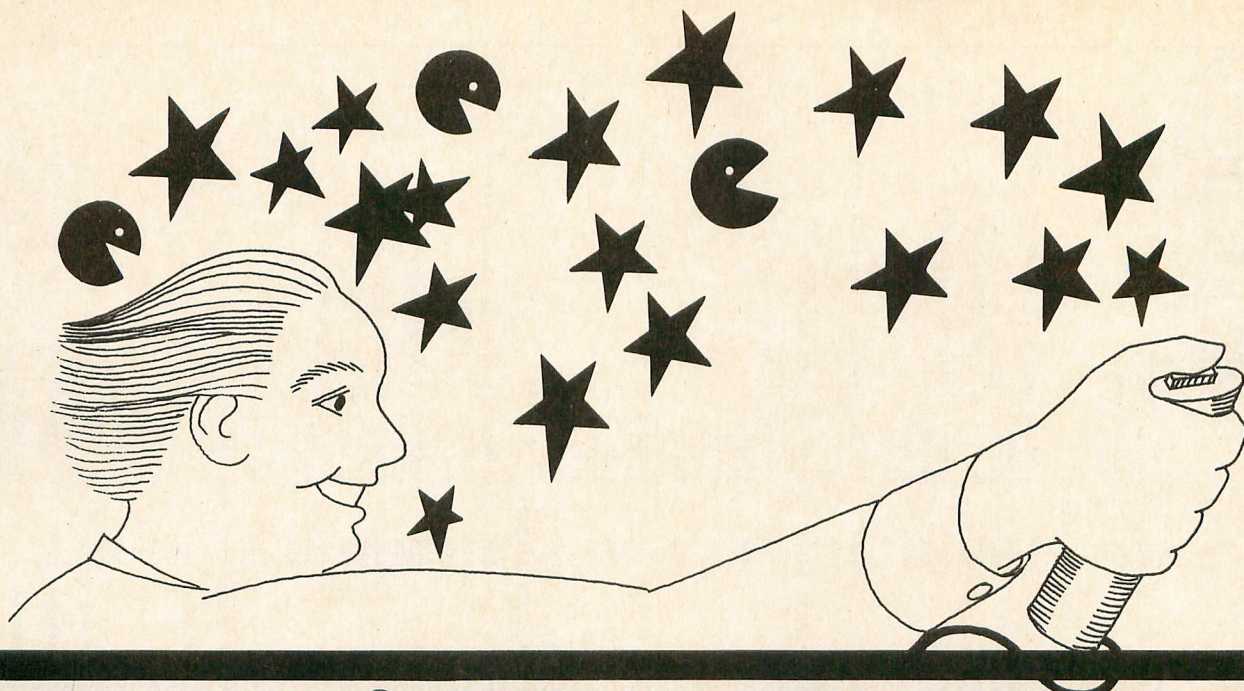
ROM (which, like my patched ROM, extends above \$D800 for about 80 bytes). Fortunately, in this instance, the author (Jeff Francis, a rising star in the world of Color Computer assembly language programming) kindly supplied me with his source code on disk, and I was able to quickly modify and reassemble a version of his utility to get it out of the way of the patches. (This is one strong argument for insisting that authors supply their source code with all utilities they sell... something very seldom done, but very useful in a pinch.)

I should note here a very recent discovery I made in the course of experimenting with other sorts of patches to other ROMs. If you wish to substitute patched EPROMs for the Disk Basic and/or the Extended Basic ROM, you need not use EPROMs that are faster than 450 ns cycle time. However, if you are working with a disk system, you would be very wise to use 250 ns cycle time EPROMs as your substitute for the Basic ROM. If you fail to heed this warning, you may wind up with a computer that appears to be working fine until you access your disk, at which point it produces blobs of black on the screen, and then crashes. I've observed this on three out of six Color Computers. The only kind of 8K by 8 EPROM that is rated at 250 ns is the 28 pin 2764. (Microprocessors Unlimited of Beggs, OK sells such a chip for under \$6 each.) To use it you will have to make an adapter that rewires about six of its pins. Careful study of the 2764's pin-out and that of the Color Computer's ROM socket will quickly reveal to the knowledgeable hardware hacker just how to wire such a socket. I have found that a 28-pin wire wrap socket and a 24-pin header make the perfect raw materials for constructing such an adapter socket.

There is one other warning I must give you relating to the copyright of the Microsoft Disk Basic ROM. When you bought your disk controller, you also bought rights to use Microsoft's Disk Basic 1.0. It is my understanding that you have the right to modify that code as you choose, *provided* you use only one modified EPROM at a time in your disk controller. You can crank out all the different EPROM versions of Disk Basic you want, but may use them only on your own computer and may use only one at a time. All other variants and the original itself must be sitting in conductive foam... *not* in another disk controller pack of yours or anyone else's. To do otherwise would be to pirate Tandy's and Microsoft's program... a morally reprehensible action and violation of federal copyright law as well!

■ ■ ■

♦ Program



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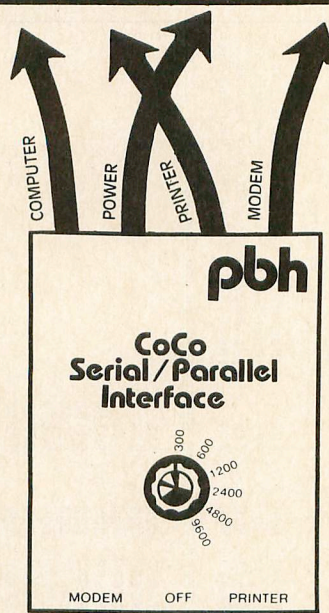
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LOADER

Program Listing. DECB2 — Assembly Language

```

00100 * DISK EXTENDED COLOR BASIC 2.0
00110 * WRITTEN BY DOUG KELLEY, 1983
00120
00130 * THESE VARIABLES CAN BE ALTERED BY USER
00140
00150 NUMERR EQU $02 ;Number of tries before error
00160 DSKONT EQU $FF ;Count-disk mtr on. 0=always on
00170 DELAY1 EQU $1E ;Primary delay for key repeat
00180 DELAY2 EQU $04 ;Secondary delay for key repeat
00190
00200 * THESE VARIABLES SHOULD REMAIN UNCHANGED
00210
00220 RTSOPC EQU $39
00230 ANDOPC EQU $84
00240 BLKSPC EQU $20
00250 KEYBUF EQU $0152
00260 IRQVEC EQU $010D
00270 ROMSTT EQU $8000
00280 ROMEND EQU $E000
00290 RAM32K EQU $FFDE
00300 RAM64K EQU $FFDF
00310 NEWERR EQU $E100
00320 NEWKEY EQU $E002
00330 NEWVEC EQU $E000
00340 VERIFY EQU $0987
00350 NEWSIN EQU $C140
00360 CLS EQU $A928
00370 SINON EQU $C125
00380 PRINT EQU $B99C
00390 NOPNOP EQU $1212
00400
00410 ORG $1000
00420
00430 START PSHS CC
00440 ORCC #$50
00450
00460 * SWITCH TO ALL RAM
00470
00480 LDX #ROMSTT
00490 LOOP1 STA RAM32K
00500 LDD ,X
00510 STA RAM64K
00520 STD ,X++
00530 CMPX #ROMEND
00540 BNE LOOP1
00550
00560 * ALLOW ACCESS TO TRACK 36
00570
00580 INC $D1B0 ;BACKUP to track 36
00590 INC $D446 ;DSKIS & DSKOS to track 36
00600 INC $D572 ;DSKINI track 35
00610
00620 * SET UP NEW ERROR CODES
00630
00640 LDX #NOPNOP ;Clear some unwanted ROM
00650 STX SC26F
00660 STX SC270
00670 STX $8902
00680 STX $8903
00690
00700 LDX #AC5A ;New jump for errors
00710 STX SC276
00720 STX $8909
00730
00740 LDX #ERRADD ;Insert new errors
00750 LDY #NEWERR
00760 LDU #ERREND-ERRADD
00770 JSR BLKMOV
00780
0002
00FF
000E
0004
0039
0084
0020
0152
010D
8000
E000
FFDE
FFDF
E100
E002
E000
0987
C140
A928
C125
B99C
1212
1000
1000 34 01
1002 1A 50
1004 8E 8000
1007 B7 FFDE
100A EC 84
100C B7 FFDF
100F ED 81
1011 8C E000
1014 26 F1
1016 7C D1B0
1019 7C D446
101C 7C D572
101F 8E 1212
1022 BF C26F
1025 BF C270
1028 BF 8902
102B BF 8903
102E 8E AC5A
1031 BF C276
1034 BF 8909
1037 8E 10BF
103A 108E E100
103E CE 029A
1041 BD 10B2

```

64K Disk Extended Color Basic 1.0

```

00790 LDX #ERRCOD ;Insert new error routine
00800 LDY #AC5A
00810 LDU #ERRCND-ERRCOD
00820 JSR BLKMOV
00830
00840 * AUTO KEY REPEAT
00850
00860
00870 LDX #KEYCOD ;Put in key repeat code
00880 LDY #NEWKEY
00890 LDU #KEYEND-KEYCOD
00900 JSR BLKMOV
00910
00920 LDX IRQVEC ;Redo 60Hz interrupt
00930 STX NEWVEC
00940 LDX #NEWKEY
00950 STX IRQVEC
00960
00970 LDX #DELAY1 ;Set up first delay time
00980 STA COUNT
00990
01000 * MAKE GREEN LETTERS ON BLACK BACKGROUND
01010
01020 LDX #BLKSPC ;Turn all spaces into black
01030 STA $A929
01040 STA $A318
01050 STA $A324
01060 STA $A359
01070 STA $A1BA
01080
01090 LDX #ANDOPC ;rewrite CHROUT
01100 STA $A340
01110 LDX #SBF
01120 STA $A341
01130 DEC $A33D
01140 DEC $A33D
01150
01160 * MISCELLANEOUS
01170
01180 LDX #NUMERR ;Number of passes before
01190 STA $D66F ;error
01200 LDX #SFF ;Turn VERIFY on
01210 STA VERIFY
01220 LDX #DSKONT ;Time disk is on
01230 STA $D6BF
01240 INC NEWSIN ;Change sign on message
01250 LDX #RTSOPC ;Don't allow restart
01260 STA START
01270 JSR CFS
01280 LDX #SINON
01290 JSR PRINT
01300
01310 PULS CC,PC
01320
01330 * BLOCK MOVE ROUTINE
01340
01350 LDX ,X+ ;Move a block of length U
01360 STA ,X+ ;from X to Y
01370 LEAU -1,U
01380 CMPU #0
01390 BNE BLKMOV
01400 RTS
01410 * NEW ERROR CODES
01420
01430 OFFSET EQU NEWERR*-1
01440 ERRADD FDB NEW0+OFFSET ;New error addresses
01450 FDB FDB NEW1+OFFSET
01460 FDB FDB NEW2+OFFSET

```



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10C5	E178	01470	FDB	NEW3+OFFSET	118D	00	02020	FCB	0	'REDEFINED ARRAY' ;?DD
10C7	E184	01480	FDB	NEW4+OFFSET	118E	524544454649	02030 NEW9	FCB	0	'REDEFINED ARRAY' ;?DD
10C9	E19A	01490	FDB	NEW5+OFFSET	118E	4E4544204152	524159	FCB	0	'REDEFINED ARRAY' ;?DD
10CB	E1A3	01500	FDB	NEW6+OFFSET	119D	00	02040	FCB	0	'DIVISION BY ZERO' ;?/0
10CD	E1B1	01510	FDB	NEW7+OFFSET	119E	444956495349	02050 NEW10	FCB	0	'DIVISION BY ZERO' ;?/0
10CF	E1C0	01520	FDB	NEW8+OFFSET	119E	4F4E20425920	5A45524F	FCB	0	'DIVISION BY ZERO' ;?/0
10D1	E1CE	01530	FDB	NEW9+OFFSET	11AE	00	02060	FCB	0	'DIVISION BY ZERO' ;?/0
10D3	E1DE	01540	FDB	NEW10+OFFSET	11AF	494C4C454741	02070 NEW11	FCB	0	'ILLEGAL DIRECT' ;?ID
10D5	E1EF	01550	FDB	NEW11+OFFSET	11AF	4C2044495245	4354	FCB	0	'ILLEGAL DIRECT' ;?ID
10D7	E1FE	01560	FDB	NEW12+OFFSET	11BD	00	02080	FCB	0	'TYPE MISMATCH' ;?TM
10D9	E20C	01570	FDB	NEW13+OFFSET	11BE	54595045204D	02090 NEW12	FCB	0	'TYPE MISMATCH' ;?TM
10DD	E220	01580	FDB	NEW14+OFFSET	11BE	49534D415443	48	FCB	0	'TYPE MISMATCH' ;?TM
10DD	E230	01590	FDB	NEW15+OFFSET	11CB	00	02100	FCB	0	'OUT OF STRING SPACE' ;?OS
10DF	E243	01600	FDB	NEW16+OFFSET	11CC	4F5554204F46	02110 NEW13	FCB	0	'OUT OF STRING SPACE' ;?OS
10E1	E252	01610	FDB	NEW17+OFFSET	11CC	20535452494E	472053504143	FCB	0	'OUT OF STRING SPACE' ;?OS
10E3	E260	01620	FDB	NEW18+OFFSET	11DF	00	02120	FCB	0	'STRING TOO LONG' ;?LS
10E5	E26D	01630	FDB	NEW19+OFFSET	11E0	535452494E47	02130 NEW14	FCB	0	'STRING TOO LONG' ;?LS
10E7	E281	01640	FDB	NEW20+OFFSET	11E0	20544F4F204C	4F4E47	FCB	0	'STRING TOO LONG' ;?LS
10E9	E28D	01650	FDB	NEW21+OFFSET	11EF	00	02140	FCB	0	'STRING TOO COMPLEX' ;?ST
10EB	E29C	01660	FDB	NEW22+OFFSET	11F0	535452494E47	02150 NEW15	FCB	0	'STRING TOO COMPLEX' ;?ST
10ED	E2A5	01670	FDB	NEW23+OFFSET	11F0	20544F4F2043	4F4D504C4558	FCB	0	'STRING TOO COMPLEX' ;?ST
10EF	E2B4	01680	FDB	NEW24+OFFSET	1202	00	02160	FCB	0	'CAN'T CONTINUE' ;?CN
10EF	E2C5	01690	FDB	NEW25+OFFSET	1203	43414E275420	02170 NEW16	FCB	0	'CAN'T CONTINUE' ;?CN
10F1	E32E	01700	FDB	NEW26+OFFSET	1203	434F4E54494E	5345	FCB	0	'CAN'T CONTINUE' ;?CN
10F3	E32E	01710	FDB	NEW27+OFFSET	1211	00	02180	FCB	0	'BAD FILE DATA' ;?FD
10F5	E2D8	01720	FDB	NEW28+OFFSET	1212	424144204649	02190 NEW17	FCB	0	'BAD FILE DATA' ;?FD
10F7	E2F4	01730	FDB	NEW29+OFFSET	1212	4C4520444154	41	FCB	0	'BAD FILE DATA' ;?FD
10F9	E2F4	01740	FDB	NEW30+OFFSET	121F	00	02200	FCB	0	'ALREADY OPEN' ;?AD
10FB	E312	01750	FDB	NEW31+OFFSET	1220	414C52454144	02210 NEW18	FCB	0	'ALREADY OPEN' ;?AD
10FD	E320	01760	FDB	NEW32+OFFSET	1220	59204F50454E	02220	FCB	0	'DEVICE/DRIVE NUMBER' ;
10FF	E32E	01770	FDB	NEW33+OFFSET	122C	00	02230 NEW19	FCB	0	'DEVICE/DRIVE NUMBER' ;
1101	E341	01780	FDB	NEW34+OFFSET	122D	444556494345	02230 NEW19	FCB	0	'DEVICE/DRIVE NUMBER' ;
1103	E350	01790	FDB	NEW35+OFFSET	122D	2P4452495645	204E554D4245	FCB	0	'DEVICE/DRIVE NUMBER' ;
1105	E35F	01800	FDB	NEW36+OFFSET	1240	00	02240	FCB	0	'INPUT/OUTPUT' ;?IO
1107	E378	01810	FDB	NEW37+OFFSET	1241	494E5055542F	02250 NEW20	FCB	0	'INPUT/OUTPUT' ;?IO
1109	E37F	01820	FDB	NEW38+OFFSET	1241	4F5554505554	02260	FCB	0	'BAD FILE MODE' ;?PM
1110B	4E4558542057	01830	NEW0	'NEXT WITHOUT FOR' ;?NF	124D	00	02270 NEW21	FCB	0	'BAD FILE MODE' ;?PM
1110B	4954484F5554	01840	NEW0	(Note:- all FCC output compressed -Ed.)	124E	424144204649	02270 NEW21	FCB	0	'NOT OPEN' ;?NO
1110B	20464F52	01850	NEW0		124E	4C45204D4F44	45	FCB	0	'INPUT PAST END' ;?IE
1111B	00	01860	FCB	'SYNTAX' ;?SN	125B	00	02280	FCB	0	'NOT OPEN' ;?NO
1111C	53594E544158	01870 NEW1	FCB	'SYNTAX' ;?SN	125C	4B4F54204F50	02290 NEW22	FCB	0	'NOT OPEN' ;?NO
1112	00	01880	FCB	'RETURN WITHOUT GOSUB' ;?RG	1264	494E50555420	02300	FCB	0	'INPUT PAST END' ;?IE
11123	52455455524E	01890 NEW2	FCB	'RETURN WITHOUT GOSUB' ;?RG	1265	504153542045	4E44	FCB	0	'DIRECT STATEMENT' ;?DS
11123	20574954484F	01900	FCB	'RETURN WITHOUT GOSUB' ;?RG	1273	00	02320	FCB	0	'DIRECT STATEMENT' ;?DS
11123	555420474F53	01910 NEW3	FCB	'RETURN WITHOUT GOSUB' ;?RG	1274	444952454354	02330 NEW24	FCB	0	'DIRECT STATEMENT' ;?DS
11123	5542	01920	FCB	'RETURN WITHOUT GOSUB' ;?RG	1284	205354415445	4D454E54	FCB	0	'DIRECT STATEMENT' ;?DS
1137	00	01900	FCB	'OUT OF DATA' ;?OD	1285	554E44454649	02330 NEW25	FCB	0	'UNDEFINED FUNCTION' ;?UF
1138	4F5554204F46	01910 NEW3	FCB	'OUT OF DATA' ;?OD	1297	4E4544204655	4E4354494F4E	FCB	0	'UNDEFINED FUNCTION' ;?UF
1143	2044415441	01920	FCB	'OUT OF DATA' ;?OD	1298	4E4544204655	4E4354494F4E	FCB	0	'UNDEFINED FUNCTION' ;?UF
1144	00	01930 NEW4	FCB	'OUT OF DATA' ;?OD	1299	554E44454649	02370 NEW26	FCB	0	'NONEXISTENT FILE' ;?NE
1144	494C4C454741	01930 NEW4	FCB	'ILLEGAL FUNCTION CALL' ;?FC	1298	4E4544204655	4E4354494F4E	FCB	0	'NONEXISTENT FILE' ;?NE
1144	4C20465554B43	01930 NEW4	FCB	'ILLEGAL FUNCTION CALL' ;?FC	1299	4E4544204655	4E4354494F4E	FCB	0	'NONEXISTENT FILE' ;?NE
1144	54494F4E2043	01930 NEW4	FCB	'ILLEGAL FUNCTION CALL' ;?FC	1299	4E4544204655	4E4354494F4E	FCB	0	'NONEXISTENT FILE' ;?NE
1144	414C4C	01930 NEW4	FCB	'ILLEGAL FUNCTION CALL' ;?FC	1299	4E4544204655	4E4354494F4E	FCB	0	'NONEXISTENT FILE' ;?NE
1159	00	01940	FCB	'OVERFLOW' ;?OV	1299	4E4544204655	4E4354494F4E	FCB	0	'NONEXISTENT FILE' ;?NE
115A	4F564552464C	01950 NEW5	FCB	'OVERFLOW' ;?OV	1299	4E4544204655	4E4354494F4E	FCB	0	'NONEXISTENT FILE' ;?NE
1162	00	01960	FCB	'OUT OF MEMORY' ;?OM	1299	4E4544204655	4E4354494F4E	FCB	0	'NONEXISTENT FILE' ;?NE
1163	4F5554204F46	01970 NEW6	FCB	'OUT OF MEMORY' ;?OM	1299	4E4544204655	4E4354494F4E	FCB	0	'NONEXISTENT FILE' ;?NE
1163	204D454D4F52	01970 NEW6	FCB	'OUT OF MEMORY' ;?OM	1299	4E4544204655	4E4354494F4E	FCB	0	'NONEXISTENT FILE' ;?NE
1170	00	01980	FCB	'UNDEFINED LINE' ;?UL	1299	4E4544204655	4E4354494F4E	FCB	0	'NONEXISTENT FILE' ;?NE
1171	554E44454649	01990 NEW7	FCB	'UNDEFINED LINE' ;?UL	1299	4E4544204655	4E4354494F4E	FCB	0	'NONEXISTENT FILE' ;?NE
1171	4E4544204C49	01990 NEW7	FCB	'UNDEFINED LINE' ;?UL	1299	4E4544204655	4E4354494F4E	FCB	0	'NONEXISTENT FILE' ;?NE
1177	00	02000	FCB	'BAD SUBSCRIPT' ;?BS	1299	4E4544204655	4E4354494F4E	FCB	0	'NONEXISTENT FILE' ;?NE
1180	424144205355	02010 NEW8	FCB	'BAD SUBSCRIPT' ;?BS	1299	4E4544204655	4E4354494F4E	FCB	0	'NONEXISTENT FILE' ;?NE
1180	425343524950	02010 NEW8	FCB	'BAD SUBSCRIPT' ;?BS	1299	4E4544204655	4E4354494F4E	FCB	0	'NONEXISTENT FILE' ;?NE
54	54	54	54	54	54	54	54	54	54	54

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PROBLEM: Disappointed with only a 32 x 16 screen and only upper case characters for your OS-9 operating system?

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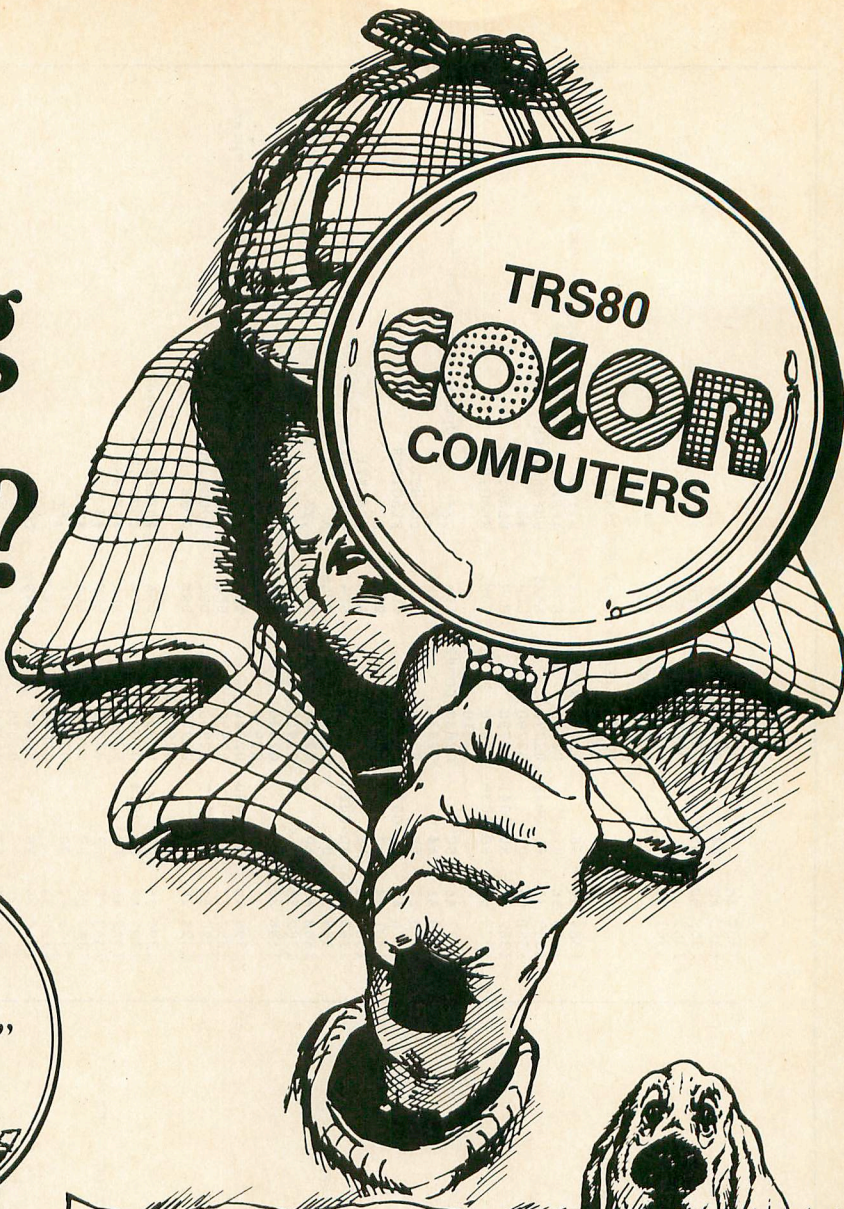
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12A8      00      02380      FCB      135C 3A      ABX
12A9      424144205245      FCC      135D AE      LDX
12B3      00      02400      FCB      135F BD      JSR
12B4      4449534B2046      FCC      1362 12      B99C
12B5      554C4C      02420      FCB      1363 12      NOP
12B6      4F5554204F46      FCC      1364      EQU
12B7      204255464645      02430      FCB
12B8      522053504143      02440      FCB
12D1      00      02440      FCB
12D2      575249544520      FCC      1364 34      PSHS
12D3      50524F544543      02450      FCB
12D4      00      02460      FCB
12D5      424144204649      FCC      1366 8E      LDX
12D6      4C4520535452      02470      FCB
12D7      534354555245      02480      FCB
12D8      00      02490      FCB
12D9      424144204649      FCC      1367 31      LEAY
12DA      4C45204E414D      02500      FCB
12DB      00      02510      FCB
12DC      00      02520      FCB
12DD      00      02530      FCB
12DE      424144204649      FCC      1368 6F      CLR
12DF      4C4520535452      02540      FCB
12E0      534354555245      02550      FCB
12E1      00      02560      FCB
12E2      424144204649      FCC      1369 31      LDB
12E3      4C4520535452      02570      FCB
12E4      534354555245      02580      FCB
12E5      00      02590      FCB
12E6      424144204649      FCC      136A 00      COM
12E7      4C4520535452      02600      FCB
12E8      534354555245      02610      FCB
12E9      00      02620      FCB
12EA      424144204649      FCC      136B 00      LDA
12EB      4C4520535452      02630      FCB
12EC      534354555245      02640      FCB
12ED      00      02650      FCB
12EE      424144204649      FCC      136C 00      CMPA
12EF      4C4520535452      02660      FCB
12F0      534354555245      02670      FCB
12F1      00      02680      FCB
12F2      424144204649      FCC      136D 00      BEQ
12F3      4C4520535452      02690      FCB
12F4      534354555245      02700      FCB
12F5      00      02710      FCB
12F6      424144204649      FCC      136E 00      CLR
12F7      4C4520535452      02720      FCB
12F8      534354555245      02730      FCB
12F9      00      02740      FCB
12FA      424144204649      FCC      136F 00      PSHS
12FB      4C4520535452      02750      FCB
12FC      534354555245      02760      FCB
12FD      00      02770      FCB
12FE      424144204649      FCC      1370 00      LEAY
12FF      4C4520535452      02780      FCB
1300      534354555245      02790      FCB
1301      00      02800      FCB
1302      424144204649      FCC      1371 00      LDB
1303      4C4520535452      02810      FCB
1304      534354555245      02820      FCB
1305      00      02830      FCB
1306      424144204649      FCC      1372 00      COM
1307      4C4520535452      02840      FCB
1308      534354555245      02850      FCB
1309      00      02860      FCB
130A      424144204649      FCC      1373 00      LDA
130B      4C4520535452      02870      FCB
130C      534354555245      02880      FCB
130D      00      02890      FCB
130E      424144204649      FCC      1374 00      CMPA
130F      4C4520535452      02900      FCB
1310      534354555245      02910      FCB
1311      00      02920      FCB
1312      424144204649      FCC      1375 00      BEQ
1313      4C4520535452      02930      FCB
1314      534354555245      02940      FCB
1315      00      02950      FCB
1316      424144204649      FCC      1376 00      CLR
1317      4C4520535452      02960      FCB
1318      534354555245      02970      FCB
1319      00      02980      FCB
131A      424144204649      FCC      1377 00      PSHS
131B      4C4520535452      02990      FCB
131C      534354555245      03000      FCB
131D      00      03010      FCB
131E      424144204649      FCC      1378 00      LEAY
131F      4C4520535452      03020      FCB
1320      534354555245      03030      FCB
1321      00      03040      FCB
1322      424144204649      FCC      1379 00      LDB
1323      4C4520535452      03050      FCB
1324      534354555245      03060      FCB
1325      00      03070      FCB
1326      424144204649      FCC      1380 00      COM
1327      4C4520535452      03080      FCB
1328      534354555245      03090      FCB
1329      00      03100      FCB
132A      424144204649      FCC      1381 00      LDA
132B      4C4520535452      03110      FCB
132C      534354555245      03120      FCB
132D      00      03130      FCB
132E      424144204649      FCC      1382 00      CMPA
132F      4C4520535452      03140      FCB
1330      534354555245      03150      FCB
1331      00      03160      FCB
1332      424144204649      FCC      1383 00      BEQ
1333      4C4520535452      03170      FCB
1334      534354555245      03180      FCB
1335      00      03190      FCB
1336      424144204649      FCC      1384 00      CLR
1337      4C4520535452      03200      FCB
1338      534354555245      03210      FCB
1339      00      03220      FCB
133A      424144204649      FCC      1385 00      PSHS
133B      4C4520535452      03230      FCB
133C      534354555245      03240      FCB
133D      00      03250      FCB
133E      424144204649      FCC      1386 00      LEAY
133F      4C4520535452      03260      FCB
1340      534354555245      03270      FCB
1341      00      03280      FCB
1342      424144204649      FCC      1387 00      LDB
1343      4C4520535452      03290      FCB
1344      534354555245      03300      FCB
1345      00      03310      FCB
1346      424144204649      FCC      1388 00      COM
1347      4C4520535452      03320      FCB
1348      534354555245      03330      FCB
1349      00      03340      FCB
134A      424144204649      FCC      1389 00      LDA
134B      4C4520535452      03350      FCB
134C      534354555245      03360      FCB
134D      00      03370      FCB
134E      424144204649      FCC      1390 00      CMPA
134F      4C4520535452      03380      FCB
1350      534354555245      03390      FCB
1351      00      03400      FCB
1352      424144204649      FCC      1391 00      BEQ
1353      4C4520535452      03410      FCB
1354      534354555245      03420      FCB
1355      00      03430      FCB
1356      424144204649      FCC      1392 00      CLR
1357      4C4520535452      03440      FCB
1358      534354555245      03450      FCB
1359      00      03460      FCB
135A      424144204649      FCC      1393 00      PSHS
135B      4C4520535452      03470      FCB
135C      534354555245      03480      FCB
135D      00      03490      FCB
135E      424144204649      FCC      1394 00      LEAY
135F      4C4520535452      03500      FCB
1360      534354555245      03510      FCB
1361      00      03520      FCB
1362      424144204649      FCC      1395 00      LDB
1363      4C4520535452      03530      FCB
1364      534354555245      03540      FCB
1365      00      03550      FCB
1366      424144204649      FCC      1396 00      COM
1367      4C4520535452      03560      FCB
1368      534354555245      03570      FCB
1369      00      03580      FCB
136A      424144204649      FCC      1397 00      LDA
136B      4C4520535452      03590      FCB
136C      534354555245      03600      FCB
136D      00      03610      FCB
136E      424144204649      FCC      1398 00      CMPA
136F      4C4520535452      03620      FCB
1370      534354555245      03630      FCB
1371      00      03640      FCB
1372      424144204649      FCC      1399 00      BEQ
1373      4C4520535452      03650      FCB
1374      534354555245      03660      FCB
1375      00      03670      FCB
1376      424144204649      FCC      1400 00      CLR
1377      4C4520535452      03680      FCB
1378      534354555245      03690      FCB
1379      00      03700      FCB
137A      424144204649      FCC      1401 00      PSHS
137B      4C4520535452      03710      FCB
137C      534354555245      03720      FCB
137D      00      03730      FCB
137E      424144204649      FCC      1402 00      LEAY
137F      4C4520535452      03740      FCB
1380      534354555245      03750      FCB
1381      00      03760      FCB
1382      424144204649      FCC      1403 00      LDB
1383      4C4520535452      03770      FCB
1384      534354555245      03780      FCB
1385      00      03790      FCB
1386      424144204649      FCC      1404 00      COM
1387      4C4520535452      03800      FCB
1388      534354555245      03810      FCB
1389      00      03820      FCB
138A      424144204649      FCC      1405 00      LDA
138B      4C4520535452      03830      FCB
138C      534354555245      03840      FCB
138D      00      03850      FCB
138E      424144204649      FCC      1406 00      CMPA
138F      4C4520535452      03860      FCB
1390      534354555245      03870      FCB
1391      00      03880      FCB
1392      424144204649      FCC      1407 00      BEQ
1393      4C4520535452      03890      FCB
1394      534354555245      03900      FCB
1395      00      03910      FCB
1396      424144204649      FCC      1408 00      CLR
1397      4C4520535452      03920      FCB
1398      534354555245      03930      FCB
1399      00      03940      FCB
139A      424144204649      FCC      1409 00      PSHS
139B      4C4520535452      03950      FCB
139C      534354555245      03960      FCB
139D      00      03970      FCB
139E      424144204649      FCC      1410 00      LEAY
139F      4C4520535452      03980      FCB
1400      534354555245      03990      FCB
1401      00      04000      FCB
1402      424144204649      FCC      1411 00      LDB
1403      4C4520535452      04010      FCB
1404      534354555245      04020      FCB
1405      00      04030      FCB
1406      424144204649      FCC      1412 00      COM
1407      4C4520535452      04040      FCB
1408      534354555245      04050      FCB
1409      00      04060      FCB
140A      424144204649      FCC      1413 00      LDA
140B      4C4520535452      04070      FCB
140C      534354555245      04080      FCB
140D      00      04090      FCB
140E      424144204649      FCC      1414 00      CMPA
140F      4C4520535452      04100      FCB
1410      534354555245      04110      FCB
1411      00      04120      FCB
1412      424144204649      FCC      1415 00      BEQ
1413      4C4520535452      04130      FCB
1414      534354555245      04140      FCB
1415      00      04150      FCB
1416      424144204649      FCC      1416 00      CLR
1417      4C4520535452      04160      FCB
1418      534354555245      04170      FCB
1419      00      04180      FCB
141A      424144204649      FCC      1417 00      PSHS
141B      4C4520535452      04190      FCB
141C      534354555245      04200      FCB
141D      00      04210      FCB
141E      424144204649      FCC      1418 00      LEAY
141F      4C4520535452      04220      FCB
1420      534354555245      04230      FCB
1421      00      04240      FCB
1422      424144204649      FCC      1419 00      LDB
1423      4C4520535452      04250      FCB
1424      534354555245      04260      FCB
1425      00      04270      FCB
1426      424144204649      FCC      1420 00      COM
1427      4C4520535452      04280      FCB
1428      534354555245      04290      FCB
1429      00      04300      FCB
142A      424144204649      FCC      1421 00      LDA
142B      4C4520535452      04310      FCB
142C      534354555245      04320      FCB
142D      00      04330      FCB
142E      424144204649      FCC      1422 00      CMPA
142F      4C4520535452      04340      FCB
1430      534354555245      04350      FCB
1431      00      04360      FCB
1432      424144204649      FCC      1423 00      BEQ
1433      4C4520535452      04370      FCB
1434      534354555245      04380      FCB
1435      00      04390      FCB
1436      424144204649      FCC      1424 00      CLR
1437      4C4520535452      04400      FCB
1438      534354555245      04410      FCB
1439      00      04420      FCB
143A      424144204649      FCC      1425 00      PSHS
143B      4C4520535452      04430      FCB
143C      534354555245      04440      FCB
143D      00      04450      FCB
143E      424144204649      FCC      1426 00      LEAY
143F      4C4520535452      04460      FCB
1440      534354555245      04470      FCB
1441      00      04480      FCB
1442      424144204649      FCC      1427 00      LDB
1443      4C4520535452      04490      FCB
1444      534354555245      04500      FCB
1445      00      04510      FCB
1446      424144204649      FCC      1428 00      COM
1447      4C4520535452      04520      FCB
1448      534354555245      04530      FCB
1449      00      04540      FCB
144A      424144204649      FCC      1429 00      LDA
144B      4C4520535452      04550      FCB
144C      534354555245      04560      FCB
144D      00      04570      FCB
144E      424144204649      FCC      1430 00      CMPA
144F      4C4520535452      04580      FCB
1450      534354555245      04590      FCB
1451      00      04600      FCB
1452      424144204649      FCC      1431 00      BEQ
1453      4C4520535452      04610      FCB
1454      534354555245      04620      FCB
1455      00      04630      FCB
1456      424144204649      FCC      1432 00      CLR
1457      4C4520535452      04640      FCB
1458      534354555245      04650      FCB
1459      00      04660      FCB
145A      424144204649      FCC      1433 00      PSHS
145B      4C4520535452      04670      FCB
145C      534354555245      04680      FCB
145D      00      04690      FCB
145E      424144204649      FCC      1434 00      LEAY
145F      4C4520535452      04690      FCB
1460      534354555245      04700      FCB
1461      00      04710      FCB
1462      424144204649      FCC      1435 00      LDB
1463      4C4520535452      04720      FCB
1464      534354555245      04730      FCB
1465      00      04740      FCB
1466      424144204649      FCC      1436 00      COM
1467      4C4520535452      04750      FCB
1468      534354555245      04760      FCB
1469      00      04770      FCB
146A      424144204649      FCC      1437 00      LDA
146B      4C4520535452      04780      FCB
146C      534354555245      04790      FCB
146D      00      04800      FCB
146E      424144204649      FCC      1438 00      CMPA
146F      4C4520535452      04810      FCB
1460      534354555245      04820      FCB
1461      00      04830      FCB
1462      424144204649      FCC      1439 00      BEQ
1463      4C4520535452      04840      FCB
1464      534354555245      04850      FCB
1465      00      04860      FCB
1466      424144204649      FCC      1440 00      CLR
1467      4C4520535452      04870      FCB
1468      534354555245      04880      FCB
1469      00      04890      FCB
146A      424144204649      FCC      1441 00      PSHS
146B      4C4520535452      04890      FCB
146C      534354555245      04900      FCB
146D      00      04910      FCB
146E      424144204649      FCC      1442 00      LEAY
146F      4C4520535452      04910      FCB
1460      534354555245      04920      FCB
1461      00      04930      FCB
1462      424144204649      FCC      1443 00      LDB
1463      4C4520535452      04930      FCB
1464      534354555245      04940      FCB
1465      00      04950      FCB
1466      424144204649      FCC      1444 00      COM
1467      4C4520535452      04950      FCB
1468      534354555245      04960      FCB
1469      00      04970      FCB
146A      424144204649      FCC      1445 00      LDA
146B      4C4520535452      04970      FCB
146C      534354555245      04980      FCB
146D      00      04990      FCB
146E      424144204649      FCC      1446 00      CMPA
146F      4C4520535452      04990      FCB
1460      534354555245      05000      FCB
1461      00      05010      FCB
1462      424144204649      FCC      1447 00      BEQ
1463      4C4520535452      05010      FCB
1464      534354555245      05020      FCB
1465      00      05030      FCB
1466      424144204649      FCC      1448 00      CLR
1467      4C4520535452      05030      FCB
1468      534354555245      05040      FCB
1469      00      05050      FCB
146A      424144204649      FCC      1449 00      PSHS
146B      4C4520535452      05050      FCB
146C      534354555245      05060      FCB
146D      00      05070      FCB
146E      424144204649      FCC      1450 00      LEAY
146F      4C4520535452      05070      FCB
1460      534354555245      05080      FCB
1461      00      05090      FCB
1462      424144204649      FCC      1451 00      LDB
1463      4C4520535452      05090      FCB
1464      534354555245      05100      FCB
1465      00      05110      FCB
1466      424144204649      FCC      1452 00      COM
1467      4C4520535452      05110      FCB
1468      534354555245      05120      FCB
1469      00      05130      FCB
146A      424144204649      FCC      1453 00      LDA
146B      4C4520535452      05130      FCB
146C      534354555245      05140      FCB
146D      00      05150      FCB
146E      424144204649      FCC      1454 00      CMPA
146F      4C4520535452      05150      FCB
1460      534354555245      05160      FCB
1461      00      05170      FCB
1462      424144204649      FCC      1455 00      BEQ
1463      4C4520535452      05170      FCB
1464      534354555245      05180      FCB
1465      00      05190      FCB
1466      424144204649      FCC      1456 00      CLR
1467      4C4520535452      05190      FCB
1468      534354555245      05200      FCB
1469      00      05210      FCB
146A      424144204649      FCC      1457 00      PSHS
146B      4C4520535452      05210      FCB
146C      534354555245      05220      FCB
146D      00      05230      FCB
146E      424144204649      FCC      1458 00      LEAY
146F      4C4520535452      05230      FCB
1460      534354555245      05240      FCB
1461      00      05250      FCB
1462      424144204649      FCC      1459 00      LDB
1463      4C4520535452      05250      FCB
1464      534354555245      05260      FCB
1465      00      05270      FCB
1466      424144204649      FCC      1460 00      COM
1467      4C4520535452      05270      FCB
1468      534354555245      05280      FCB
1469      00      05290      FCB
146A      424144204649      FCC      1461 00      LDA
146B      4C4520535452      05290      FCB
146C      534354555245      05300      FCB
146D      00      05310      FCB
146E      424144204649      FCC      1462 00      CMPA
146F      4C4520535452      05310      FCB
1460      534354555245      05320      FCB
1461      00      05330      FCB
1462      424144204649      FCC      1463 00      BEQ
1463      4C4520535452      05330      FCB
1464      534354555245      05340      FCB
1465      00      05350      FCB
1466      424144204649      FCC      1464 00      CLR
1467      4C4520535452      05350      FCB
1468      534354555245      05360      FCB
1469      00      05370      FCB
146A      424144204649      FCC      1465 00      PSHS
146B      4C4520535452      05370      FCB
146C      534354555245      05380      FCB
146D      00      05390      FCB
146E      424144204649      FCC      1466 00      LEAY
146F      4C4520535452      05390      FCB
1460      534354555245      05400      FCB
1461      00      05410      FCB
1462      424144204649      FCC      1467 00      LDB
1463      4C4520535452      05410      FCB
1464      534354555245      05420      FCB
1465      00      05430      FCB
1466      424144204649      FCC      1468 00      COM
1467      4C4520535452      05430      FCB
1468      534354555245      05440      FCB
1469      00      05450      FCB
146A      42414420
```


Telewriter-64™

the Color Computer Word Processor

- **3 display formats: 51/64/85 columns × 24 lines**
- **True lower case characters**
- **User-friendly full-screen editor**
- **Right justification**
- **Easy hyphenation**
- **Drives any printer**
- **Embedded format and control codes**
- **Runs in 16K, 32K, or 64K**
- **Menu-driven disk and cassette I/O**
- **No hardware modifications required**

THE ORIGINAL

Simply stated, Telewriter is the most powerful word processor you can buy for the TRS-80 Color Computer. The original Telewriter has received rave reviews in every major Color Computer and TRS-80 magazine, as well as enthusiastic praise from thousands of satisfied owners. And rightly so.

The standard Color Computer display of 32 characters by 16 lines without lower case is simply inadequate for serious word processing. The checkerboard letters and tiny lines give you no feel for how your writing looks or reads. Telewriter gives the Color Computer a 51 column by 24 line screen display with *true lower case characters*. So a Telewriter screen looks like a printed page, with a good chunk of text on screen at one time. In fact, more on screen text than you'd get with Apple II, Atari, TI, Vic or TRS-80 Model III.

On top of that, the sophisticated Telewriter full-screen editor is so simple to use, it makes writing fun. With single-letter mnemonic commands, and menu-driven I/O and formatting, Telewriter surpasses all others for user friendliness and pure power.

Telewriter's chain printing feature means that the size of your text is never limited by the amount of memory you have, and Telewriter's advanced cassette handler gives you a powerful word processor without the major additional cost of a disk.

...one of the best programs for the Color Computer I have seen...

— Color Computer News, Jan. 1982

TELEWRITER-64

But now we've added more power to Telewriter. Not just bells and whistles, but major features that give you total control over your writing. We call this new supercharged version Telewriter-64. For two reasons.

64K COMPATIBLE

Telewriter-64 runs fully in any Color Computer — 16K, 32K, or 64K, with or without Extended Basic, with disk or cassette or both. It automatically configures itself to take optimum advantage of all available memory. That means that when you upgrade your memory, the Telewriter-64 text buffer grows accordingly. In a 64K cassette based system, for example, you get about 40K of memory to store text. So you don't need disk or FLEX to put all your 64K to work immediately.

64 COLUMNS (AND 85!)

Besides the original 51 column screen, Telewriter-64 now gives you 2 additional high-density displays: 64 × 24 and 85 × 24! Both high density modes provide all the standard Telewriter editing capabilities, and you can switch instantly to any of the 3 formats with a single control key command.

The 51 × 24 display is clear and crisp on the screen. The two high density modes are more crowded and less easily readable, but they are perfect for showing you the exact layout of your printed page, *all on the screen at one time*. Compare this with cumbersome "windows" that show you only fragments at a time and don't even allow editing.

RIGHT JUSTIFICATION & HYPHENATION

One outstanding advantage of the full-width screen display is that you can now set the screen width to match the width of your printed page, so that "what you see is what you get." This makes exact alignment of columns possible and it makes hyphenation simple.

Since short lines are the reason for the large spaces often found in standard right justified text, and since hyphenation is the most effective way to eliminate short lines, Telewriter-64 can now promise you some of the best looking right justification you can get on the Color Computer.

FEATURES & SPECIFICATIONS:

Printing and formatting: Drives any printer (LPVII/VIII, DMP-100/200, Epson, Okidata, Centronics, NEC, C. Itoh, Smith-Corona, Terminet, etc).

Embedded control codes give full dynamic access to intelligent printer features like: underlining, subscript, superscript, variable font and type size, dot-graphics, etc.

Dynamic (embedded) format controls for: top, bottom, and left margins; line length, lines per page, line spacing, new page, change page numbering, conditional new page, enable/disable justification.

Menu-driven control of these parameters, as well as: pause at page bottom, page numbering, baud rate (so you can run your printer at top speed), and Epson font. "Typewriter" feature sends typed lines directly to your printer, and Direct mode sends control codes right from the keyboard. Special Epson driver simplifies use with MX-80.

Supports single and multi-line headers and automatic centering. Print or save all or any section of the text buffer. Chain print any number of files from cassette or disk.

File and I/O Features: ASCII format files — create and edit BASIC, Assembly, Pascal, and C programs, Smart Terminal files (for uploading or downloading), even text files from other word processors. Compatible with spelling checkers (like Spell 'n Fix).

Cassette verify command for sure saves. Cassette auto-retry means you type a load command only once no matter where you are in the tape.

Read in, save, partial save, and append files with disk and/or cassette. For disk: print directory with free space to screen or printer, kill and rename files, set default drive. Easily customized to the number of drives in the system.

Editing features: Fast, full-screen editor with wordwrap, block copy, block move, block delete, line delete, global search and replace (or delete), wild card search, fast auto-repeat cursor, fast scrolling, cursor up, down, right, left, begin line, end line, top of text, bottom of text; page forward, page backward, align text, tabs, choice of buff or green background, complete error protection, line counter, word counter, space left, current file name, default drive in effect, set line length on screen.

Insert or delete text anywhere on the screen without changing "modes." This fast "free-form" editor provides maximum ease of use. Everything you do appears immediately on the screen in front of you. Commands require only a single key or a single key plus CLEAR.

*...truly a state of the art word processor...
outstanding in every respect.*

— The RAINBOW, Jan. 1982

PROFESSIONAL WORD PROCESSING

You can no longer afford to be without the power and efficiency word processing brings to everything you write. The TRS-80 Color Computer is the lowest priced micro with the capability for serious word processing. And only Telewriter-64 fully unleashes that capability.

Telewriter-64 costs \$49.95 on cassette, \$59.95 on disk, and comes complete with over 70 pages of well-written documentation. (The step-by-step tutorial will have your writing with Telewriter-64 in a matter of minutes.) To order, send check or money order to:

Cognitec
704 N. Nob Ave.
Del Mar, CA 92014

Or check your local software store. If you have questions, or would like to order by Visa or Mastercard, call us at (619) 755-1258 (weekdays, 8AM-4PM PST). Dealer inquiries invited.

(Add \$2 for shipping. Californians add 6% state tax. Allow 2 weeks for personal checks. Send self-addressed stamped envelope for Telewriter reviews from CCN, RAINBOW, 80-Micro, 80-U.S. Telewriter owners: send SASE or call for information on upgrading to Telewriter-64. Telewriter-compatible spelling checker (Spell 'n Fix) and Smart Terminal program (Colorcom/E) also available. Call or write for more information.)

Apple II is a trademark of Apple Computer, Inc.; Atari is a trademark of Atari, Inc.; TRS-80 is a trademark of Tandy Corp; MX-80 is a trademark of Epson America, Inc.

Program Listing. DECB2 — Basic



64 K Disk Extended Color Basic 1.0

```

0 'DISK EXTENDED COLOR BASIC 2.0
  LOADER. *SAVE BEFORE RUNNING!*

10 PCLEAR4: CLS: PRINT@70,"LOADI
  NG DECB 2.0": LN=100: PRINT

20 FOR A=&H1000 TO&H13BF STEP32
30 SM=0: FOR AD=A TO A+31
40 READ B: SM=SM+B: IF B <> (255
  AND B) THEN F=1: GOTO 60 ELSE
  POKE AD,B: NEXT AD
50 READ B: IF SM=B THEN LN=LN+10
  : NEXT A: SAVEM "DECB2",&H1000,&
  H13BF,&H1000: PRINT" DECB 2.0 SA
  VED.": INPUT " PRESS <ENTER> TO
  EXECUTE";DY$: EXEC &H1000: NEW

60 PRINT" * DATA ERROR IN LINE"L
  N: IF F THEN PRINT" VALUE OF"B"O
  UT OF BOUNDS" ELSE PRINT" CHECKS
  UM READ ="B," CALCULATED ="SM

70 PRINT:PRINT " RE-SAVE & RE-RU
  N WHEN FIXED": END

100 DATA 52,1,26,80,142,128,0,18
  3,255,222,236,132,183,255,223,23
  7,129,140,224,0,38,241,124,209,1
  76,124,212,70,124,213,114,142,46
  35

110 DATA 18,18,191,194,111,191,1
  94,112,191,137,2,191,137,3,142,1
  72,90,191,194,118,191,137,9,142,
  16,191,16,142,225,0,206,2,3874

120 DATA 166,189,16,178,142,19,1
  01,16,142,172,90,206,0,11,189,16
  ,178,142,19,112,16,142,224,2,206
  ,0,80,189,16,178,190,1,3348

130 DATA 13,191,224,0,142,224,2,
  191,1,13,134,30,183,19,194,134,3
  2,183,169,41,183,163,24,183,163,
  36,183,163,89,183,161,186,3837

```

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140 DATA 134,132,183,163,64,134,
191,183,163,65,122,163,61,122,16
3,61,134,2,183,214,111,134,255,1
83,9,135,134,255,183,214,191,124
,4565

150 DATA 193,64,134,57,183,16,0,
189,169,40,142,193,37,189,185,15
6,53,129,166,128,167,160,51,95,1
7,131,0,0,38,244,57,225,3608

160 DATA 75,225,92,225,99,225,12
0,225,132,225,154,225,163,225,17
7,225,192,225,206,225,222,225,23
9,225,254,226,12,226,32,226,48,2
26,5821

170 DATA 67,226,82,226,96,226,10
9,226,129,226,142,226,156,226,17
0,226,185,226,202,226,221,226,23
8,227,0,227,10,227,30,227,44,227
,5502

180 DATA 58,227,77,227,92,227,10
7,227,132,227,139,78,69,88,84,32
,87,73,84,72,79,85,84,32,70,79,8
2,0,83,89,78,84,3252

190 DATA 65,88,0,82,69,84,85,82,
78,32,87,73,84,72,79,85,84,32,71
,79,83,85,66,0,79,85,84,32,79,70

,32,68,2174

200 DATA 65,84,65,0,73,76,76,69,
71,65,76,32,70,85,78,67,84,73,79
,78,32,67,65,76,76,0,79,86,69,82
,70,76,2144

210 DATA 79,87,0,79,85,84,32,79,
70,32,77,69,77,79,82,89,0,85,78,
68,69,70,73,78,69,68,32,76,73,78
,69,0,2086

220 DATA 66,65,68,32,83,85,66,83
,67,82,73,80,84,0,82,69,68,69,70
,73,78,69,68,32,65,82,82,65,89,0
,68,73,2136

230 DATA 86,73,83,73,79,78,32,66
,89,32,90,69,82,79,0,73,76,76,69
,71,65,76,32,68,73,82,69,67,84,0
,84,89,2165

240 DATA 80,69,32,77,73,83,77,65
,84,67,72,0,79,85,84,32,79,70,32
,83,84,82,73,78,71,32,83,80,65,6
7,69,0,2107

250 DATA 83,84,82,73,78,71,32,84
,79,79,32,76,79,78,71,0,83,84,82
,73,78,71,32,84,79,79,32,67,79,7
7,80,76,2237

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26-1173 RS D.C. Modem 2	\$179.95
Novation J-CAT Modem	\$129.95
RS D.C. Modem 1.....	\$89.95
RS D.C. Modem 2.....	\$179.95
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USR 300/1200 Password	\$449.95
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Botec SER/PAC Interface.....	\$69.95

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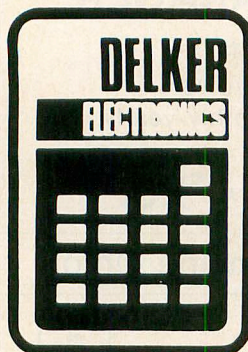
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 notice.

260 DATA 69,88,0,67,65,78,39,84,
 32,67,79,78,84,73,78,85,69,0,66,
 65,68,32,70,73,76,69,32,68,65,84
 ,65,0,1968
 270 DATA 65,76,82,69,65,68,89,32
 ,79,80,69,78,0,68,69,86,73,67,69
 ,47,68,82,73,86,69,32,78,85,77,6
 6,69,82,2198
 280 DATA 0,73,78,80,85,84,47,79,
 85,84,80,85,84,0,66,65,68,32,70,
 73,76,69,32,77,79,68,69,0,70,73,
 76,69,2076
 290 DATA 32,78,79,84,32,79,80,69
 ,78,0,73,78,80,85,84,32,80,65,83
 ,84,32,69,78,68,0,68,73,82,69,67
 ,84,32,2077
 300 DATA 83,84,65,84,69,77,69,78
 ,84,0,85,78,68,69,70,73,78,69,68
 ,32,70,85,78,67,84,73,79,78,0,78
 ,79,78,2232
 310 DATA 69,88,73,83,84,69,78,84
 ,32,70,73,76,69,0,66,65,68,32,82
 ,69,67,79,82,68,32,78,85,77,66,6
 9,82,0,2115
 320 DATA 68,73,83,75,32,70,85,76
 ,76,0,79,85,84,32,79,70,32,66,85
 ,70,70,69,82,32,83,80,65,67,69,0
 ,87,82,2106
 330 DATA 73,84,69,32,80,82,79,84
 ,69,67,84,0,66,65,68,32,70,73,76
 ,69,32,78,65,77,69,0,66,65,68,32
 ,70,73,2017
 340 DATA 76,69,32,83,84,82,85,67
 ,84,85,82,69,0,65,76,82,69,65,68
 ,89,32,69,88,73,83,84,83,0,70,73
 ,69,76,2212
 350 DATA 68,32,79,86,69,82,70,76
 ,79,87,0,83,69,84,32,84,79,32,78
 ,79,78,70,73,69,76,68,69,68,32,8
 3,84,82,2200
 360 DATA 73,78,71,0,86,69,82,73,
 70,89,0,65,67,67,69,83,83,32,80,
 65,83,84,32,69,78,68,32,79,70,32
 ,82,69,2080
 370 DATA 67,79,82,68,0,142,225,0
 ,58,174,132,189,185,156,18,18,52
 ,54,142,1,82,49,141,0,75,198,8,1
 11,141,0,65,99,2811
 380 DATA 141,0,61,166,128,161,16
 4,39,14,111,141,0,51,52,2,134,30
 ,167,141,0,45,53,2,167,160,90,38
 ,231,109,141,0,32,2771
 390 DATA 39,24,106,141,0,28,38,1
 8,134,4,167,141,0,20,142,1,82,19
 8,8,134,255,167,128,90,38,251,53
 ,54,110,159,224,0,2954

Program Listing. Goodman's Patch.



16 K disk Extended Color Basic 1.0
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```

0001 0E00      NAM      PATCH
* ADDRESS OF DATA IN LOW RAM *
* WHEN IT IS BEING PATCHED. *
LORAM EQU $2000
OFFSET EQU $C000-LORAM

* PATCH SEEK TRACK ROUTINE TO *
* RESTORE HEAD TO ZERO IF THIS *
* IS THE FIRST TIME THIS DRIVE *
* WAS SELECTED. *
ORG $D714-OFFSET
JSR PATCH1+OFFSET

0004 0E00      ORG      $D7DD-OFFSET
0005 3714 BDD7DD
0006 3717      ORG      $D7DD-OFFSET
0007 37DD C1FF      PATCH1 CMPB #$FF      FIRST USE OF
0008 37DF 2608      BNE A@      THIS DRIVE?
0009 37E1 3410      PSHS X      PRESERVE X REG.
0010 37E3 BDD6C5      JSR $D6C5      GO TO TRACK 0
0011 37E6 3510      PULS X
0012 37E8 5F      CLRB
0013 37E9 F7FF49      STB $FF49      SET B=TRACK 0
0014 37EC 39      RTS      SET TRACK #.

* PATCH SELECT DISK ROUTINE TO *
* DELAY APPROX. 80 MS. WHENEVER *
* A DIFFERENT DRIVE IS SELECTED *
* TO ALLOW FOR HEAD SETTTLING ON *
* DRIVES WITH HEAD SOLOINIDS. *
ORG $D68F-OFFSET
JSR PATCH2+OFFSET
STA $986
REORG

0015 37ED      PATCH2 STA $FF40      SELECT DRIVE.
0016 368F BDD7ED      EORA $986      DIFFERENT
0017 3692 B70986      BITA #$47      DRIVE?
0018 3695      BEQ A@      SKIP IF SAME.
0019 37ED B7FF40      JSR $D6FD      DELAY 80MS.
0020 37F0 B80986      EORA $986      RESTORE MASK.
0021 37F3 8547      RTS
0022 37F5 2703
0023 37F7 BDD6FD
0024 37FA B80986
0025 37FD 39

* PATCH INITIALIZATION ROUTINE *
* SET ALL TRACK #'S TO $FF FOR *
* FLAG TO INDICATE DRIVE NEVER *
* USED BEFORE & TURN VERIFY ON. *
* ALSO DO AUTO-BOOT IF SPC BAR *
* HELD DOWN DURING WARM RESET. *
ORG $C0D1-OFFSET
JMP PATCH3+OFFSET
REORG

0026 37FE      PATCH3 LDD #$FFFF      SET ALL
0027 20D1 7ED7FE      STD $97E      TRACKS TO $FF
0028 20D4      STD $980      VERIFY ON
0029 37FE CCEFFF      LDA #18      SET PRINTER
0030 3801 FD097E      STA 150      BAUD=2400
0031 3804 FD0980      BSR CKBOOT    CHECK BOOT
0032 3807 B70987      JMP $A0E2    NORMAL START
0033 380A 8612
0034 380C 9796
0035 380E 8D09
0036 3810 7EA0E2

0037 3813      ORG      $C0CC-OFFSET
0038 20CC 8ED813      LDX #PATCH4+OFFSET
0039 20CF      REORG

0040 3813 12      PATCH4 NOP      FOR RESET
0041 3814 8D03      BSR CKBOOT    CHECK BOOT
0042 3816 7EC0D4      JMP $C0D4      NORMAL WARM

* CHECK KEYBOARD, IF SPACE BAR *
* HELD DOWN THEN SET VECTOR TO *
* 'DOBOOT' AT LINE INPUT TRAP. *
CKBOOT LDA #$7F      CHECK IF
STA $FF02      SPACE BAR IS
LDB $FF00      DEPRESSED.
LDA $FF00      RESET KEYBD.
STA $FF02
ANDB #8
BNE A@      SKIP IF SPACE
LDX #DOBOOT+OFFSET    NOT PRESSED.
STX $183      LINE IN TRAP
RTS

A@
* VECTOR HERE FOR FIRST INPUT *
* LINE AFTER AUTO-BOOT. THE *
* NORMAL VECTOR IS RESTORED, *
* THEN A POINTER TO THE BOOT *
* LINE IS RETURNED. *
DOBOOT LEAS 2,S      CANCEL RETURN
LDX #C687      RESTORE
STX $183      VECTOR
LDX #BOOT+OFFSET-1
CLRA      CLEAR CARRY
RTS      RUN BOOT

* LINE RETURNED TO BASIC FOR *
* AUTO-BOOT. BASIC EXECUTES *
* THIS JUST AS IF IT WAS TYPED *
* FROM THE KEYBOARD. *
BOOT FCC $C0D1-OFFSET
END

```


SYSTEM H

Examining the intersection of

illustration by Marjorie Strauss

Marjorie Strauss

ORIZONS



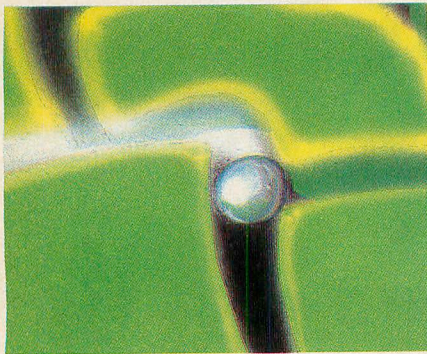
commands and operating systems.

by Stephen P. Allen

INSIDE YOUR COLOR Computer, as in all computers, is an operating system (OS) that takes control when the computer is turned on. The operating system in the Color Computer is Basic. Basic essentially has two parts — first, it is a controller, making sure computer hardware is set up correctly, allocating memory space, keeping track of where the computer “is” at all times. The second part is a collection of routines and subroutines that execute Basic commands.

Let’s examine the routine that is invoked when you List a Basic program.

List actually starts with `LLIST`, and is also called from `CSAVE,A`. We’ll look at a few commands relating to these routines. Turn on your disassembler and have a look . . .



Find The Tokens

Microsoft Basic is a tokenized Basic. What does that mean? Type in a line in Basic. When you hit Enter, the operating system examines the line for Basic words (FOR, NEXT, IF, etc.) and converts them into numbers. These numbers are called *tokens*. Tokens make the program a lot easier to execute at run time, because the token contains vital information concerning the location of the word's routine in the ROM. Half the work of decoding the word and finding the routine is done by the time the program runs.

Tokens conserve memory. LIST is a four letter word. \$94 (the token for List) takes one quarter the memory space.

In order to List — indeed, in order to run Basic at all — the system must know what is a token and what isn't. This is how Microsoft does it:

An element in a Basic program is either ASCII or a token. ASCII uses only the least (rightmost) seven of eight bits. If you look at any ASCII digit as a two's complement number, it is always positive. Microsoft craftily said, "OK then, we make all our tokens negative!" A token (in its simplest form) is an offset into a table, with \$80 added (setting the sign bit) to make it negative and so distinguish it from ASCII.

However, that is not all there is to it. There are some tokens with two bytes. The first byte is either \$FF or \$3A. \$FF is used to differentiate between several token tables.

\$B7DF in Figure 1 shows a trick Microsoft uses a lot: CMPX #8621 does nothing. Skip the CMPX# opcode, however (branch to \$B7E0), and \$8621 loads A with an exclamation point. This is the symbol Basic uses for a token it couldn't find a word for (try listing a tokenized disk program on a Color Computer without disks).

Find The Word

At this point things get a little complicated. There is a "Table of Tables" in Basic reserved RAM. This table is used by the operating system to locate the tables

of keywords and subroutine addresses in ROM. As part of the initialization process, Color Basic moves some data concerning its token tables down into RAM. If you have Extended or Disk Basic, those ROMs copy their token table data next to the first.

The address of the Table of Tables is \$120. Figure 2 shows it for Extended Basic. At \$125 and \$12F are tables for

two-byte tokens, where the first byte is \$FF.

Microsoft again cleverly uses the seven-bit ASCII code, this time to mark the end of a Basic word in the ROM tables. It does this by setting the left-most bit of the last letter, so that the last letter is negative. Thus, Asc is not \$41, \$53, \$43 but \$41, \$53, \$C3. Figure 3 shows how all these tables are used by List.

B7C2	JSR	\$1A6	RAM hook, RTS in Extended BASIC
	LEAX	4,X	Point to start of line contents
	LDY	#2DD	Decoded test will be copied to here
B7CB	LDA	,X+	Next line element
	BEQ	\$B820	RTS if done this line
	BMI	\$B7E6	If token
	CMPA	#3A	Is this an oddball?
	BNE	\$B7E2	No
	LDB	,X	Check next byte
	CMPB	#\$84	"ELSE"?
	BEQ	\$B7CB	Yes
	CMPB	#\$83	"" (remark)?
	BEQ	\$B7CB	Yes
B7DF	CMPX	#\$8621	\$8621 is LDA #21 (ASCII for "!")
B7E2	BSR	\$B814	Store this non-token character
	BRA	\$B7CB	Do next element

Figure 1. A Microsoft Trick

Figure 2. "Table of Tables"

120	35	54 entries this table
	AA66	BASIC words start here
	AB67	Subroutine addresses start here
125	14	20 entries this table
	AB1A	BASIC words start here
	AA29	Subroutine addresses start here
12A	19	25 entries this table
	8183	Extended words start here
	813C	Address of special routine to find addresses
12F	0E	14 entries this table
	821E	Extended words start here
	8168	Address of special routine to find addresses

Figure 3. Table User code uses Figure 2 to locate the proper table and copy the word from it.

B7E6	LDU	#\$116	Table of tables minus 10: prep for loop
	CMPA	#\$FF	Is token found in 2nd or fourth table?
	BNE	\$B7F1	No
	LDA	,X+	Move past \$FF, get "real" token
	LEAU	5,U	Move into tables for "\$FF" tokens
B7F1	ANDA	#\$7F	Drop MSB, make into an offset
B7F3	LEAU	\$0A,U	Move up two tables
	TST	,U	End of table of tables?
B7F7	BEQ	\$B7E0	Yes, can't find that word!
	SUBA	,U	Is it in this table?
	BPL	\$B7F3	No, try the next one
	ADDA	,U	This table: restore offset
	LDU	1,U	Point U to word table
B801	DECA		Use token as offset
	BMI	\$B80A	Found the word: copy to buffer
B804	TST	,U+	Not the word: move
	BPL	\$B804	past it and point U
	BRA	\$B801	to next word
B80A	LDA	,U	Get a letter from word
	BSR	\$B814	Put it in buffer
	TST	,U+	Was that the last letter?
	BPL	\$B80A	No, keep going
	BRA	\$B7CB	Done, get next line element
B814	CMPY	#\$3D6	249 characters in buffer already?
	BHS	\$B820	Yes: no room
	ANDA	#\$7F	Mask MSB (for last letter)
	STA	,Y+	Into the buffer
	CLR	,Y	Mark possible end of string
B820	RTS		

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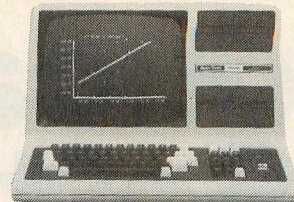
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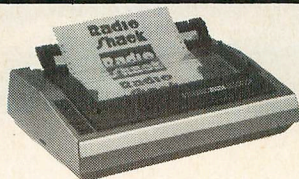
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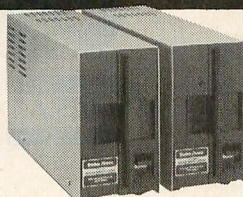
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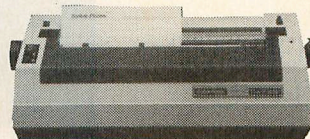
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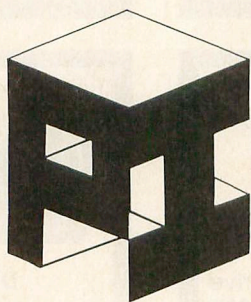
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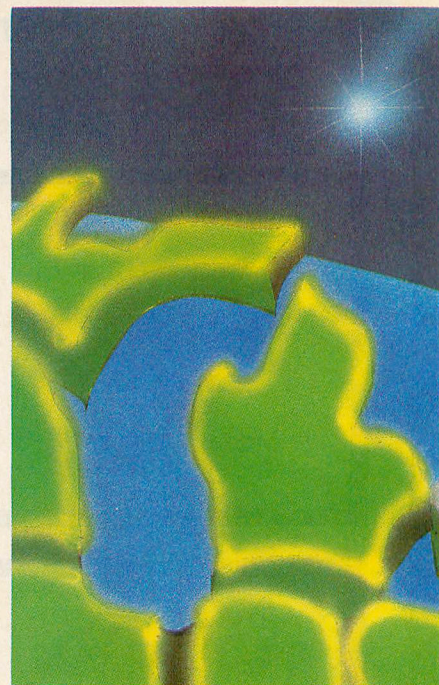
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The Subroutine at \$9F

Probably the most often-called routine in the Color Computer is copied from ROM into the *scratchpad* area Basic reserves for itself whenever the computer is turned on. (The scratchpad area is low RAM, from \$0000 through \$03FF. It gets used for storing pointers, temporary results, file names, addresses, counters, and buffers. Refer to Jake Commander's Memory Map, April 1983.) This routine is located at \$9F, and its purpose is to get the next character in a Basic line (skipping spaces), put it in the A register, and set some flags according to what kind of character it is. It's in RAM because it's a *self-modifying* routine — that is, it alters its own code.

This routine reports that there is no next character at a colon or end of line by setting the zero flag to 1, and that the next character is an ASCII digit by setting the carry flag to 1. If the Basic interpreter needs to know the current character instead of the next one, it can call this routine at \$A5 instead of \$9F.

To execute a tokenized Basic word, the interpreter uses the token to examine the Table of Tables to find the correct table of execution addresses. Then the corresponding table address is pulled (using the remainder of the token's value) and the routine at \$9F is called before jumping to the token's address.

In this way all instruction subroutines are entered with the next character in A and flags set according to what that character is. Many routines start with a conditional branch based on the \$9F call

results. List is one of them, though the branch doesn't appear for six instructions.

Getting Parameters

Figure 4 is the assembly language routine that gets the line number parameters. To get the line numbers that *may* have been typed after the List command itself, the flags set by the \$9F routine come in handy. The general-purpose ASCII to binary routine at \$AF67 is also used to advantage. It returns a value of zero if no number is found, and so is called before branching on the \$9F routines flags. This provides the "implied first line" feature. The first line number to be listed is stored at \$66 and the last line number to list is stored at \$2B.

\$AF67 uses the \$9F routine to get ASCII digits to work on, and quits when

it runs out of them. When it returns, \$A6 points to the next character beyond the number. If you execute JSR \$9F at this point, you skip the next character. This is why Basic calls \$A5 at \$B772 instead of \$9F.

Main Loop

The main loop of the List routine is concerned with processing lines of Basic. It calls subroutines that deal with the elements in the lines (see Figure 5). Here is the format for a line of a Basic program in memory: address of next line (two bytes); number of this line (two bytes); the contents of the line; and zero, marks end of line (one byte).

There's a lot going on, isn't there! Think of the incredible amount of processing that occurs next time you simply List a Basic program. ■ ■ ■

L	LLIST	ORG	\$B75E	
		LDB	#\$FE	#-2
L		STB	\$6F	to DEVNUM
		JSR	\$A5	Restore any modified flags
L	LIST	PSHS	CC	Save the flags
		JSR	\$AF67	Line # to \$2B
L		JSR	\$AD01	Find line, or next larger one
		STX	\$66	Start line: put it here
L		PULS	CC	What was that first character?
		BEQ	\$B784	Oh, list ALL lines!
B	B772	JSR	\$A5	Get char. after number
		BEQ	\$B789	List one line only
L		CMP	#\$AC	Token for "--"
		BNE	\$B783	Gotta have a dash here!
L		JSR	\$9F	Check for 2nd line #
		BEQ	\$B784	There ain't any
L		JSR	\$AF67	Get "to" line #
		BEQ	\$B789	Nothing after "to" line: very good
B	B783	RTS		Abort! Syntax Error!
B	B784	LDU	#\$FFFF	Max # possible
		STU	\$2B	to end line
B	B789	LEAS	2,S	This is no longer a subroutine

Figure 4. Parameter Parsing in List

B78B	LDX	\$66	Address of first line
B78D	JSR	\$B95C	Open file for CSAVE,A: else do linefeed
	JSR	\$A549	Check for Break, Shift @
	LDD	,X	If last line, D gets zero
	BNE	\$B79F	Not last line yet
B797	JSR	\$A42D	Done: close files if CSAVE,A
	CLR	\$6F	Make sure output goes to screen
	JMP	\$AC73	"OK"
B79F	STX	\$66	Address of current line
	LDD	2,X	Get line #
	CMPD	\$2B	Have we already done last line?
	BHI	\$B797	Yes
	JSR	\$BDCC	Convert line # to ASCII string
	JSR	\$B9AC	Print it
	LDX	\$66	Point to line
	BSR	\$B7C2	De-tokenize, copy to 2DD
	LDX	[\$66]	Address of next line
	LDU	#\$2DD	Point to buffer
B7B9	LDA	,U+	Get character
	BEQ	\$B78D	If done this line
	JSR	\$B9B1	JMP "Chrout"
	BRA	\$B7B9	Next character

Figure 5. Main Loop of List

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The Color Compiler features a total of 55 commands and functions. Most of these are a subset of Extended Color Basic. The Color Compiler is limited to integer variables. All floating point can be done in a Basic program which calls the compiled program. Passing information from Basic to compiled programs is very easy. **And Strings are fully supported!** The Color Compiler generates position independent code so that you may put the compiled program anywhere in memory, including into a ROM-pack. It requires 32K and a disk drive, leaving 16K of user work space. (Room for a program with up to 200 lines and 100 line references.)

\$39.95

Functions Supported

ABS	INKEY\$	JOYSTK	PEEK	PEEK#
PPOINT	RND	SGN	SQR	TIMER
+	-	*	/	=
=	=	AND	OR	NOT
ASC	LEN	VAL	CHR\$	MID\$
STR\$				

Instructions Supported

CIRCLE	CLS	COLOR	DATA
DIM	END	EXEC	FOR-STEP-NEXT
GET	GOSUB	GOTO	IF-THEN-ELSE
LET	LINE	MOTOR	ON n GOTO or GOSUB
PAINT	PCLS	PCOPY	Pmode
POKE	POKE#	PRESET	PRINT
PSET	PUT	READ	PRINT@
REM	RESTORE	RETURN	SCREEN
SOUND			



FOXY GRAF

FOXY GRAF is a complete graphics development package for the assembly language programmer. The very comprehensive manual covers the history of graphics, how the Color Computer graphics work, details Radio Shack & Motorola wouldn't tell, & is written in an enjoyable style. You can program with any mode in any color combination. It is totally relocatable & includes some very useful subroutines you can call from standard Basic. If you are serious about learning graphics programming, Foxy Graf is both a tutorial & a tool! (Requires 16K)

Cassette \$29.95

Disk \$34.95

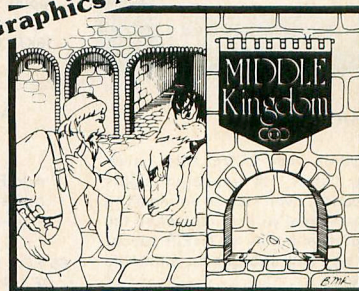
The same **Junior** you've seen in the **Kong** arcade series! This young but tireless little ape must overcome four screens of obstacles to rescue his father, The King, from mean old Luigi. He will traverse the jungle & swamp, climb vines, avoid vine gators, dodge Zuzu birds, open locks, & finally conquer Luigi's hideout before he finally frees his big daddy. (Requires 32K & a joystick)

Cassette \$27.95

Disk \$31.95



NEW Graphics Adventure



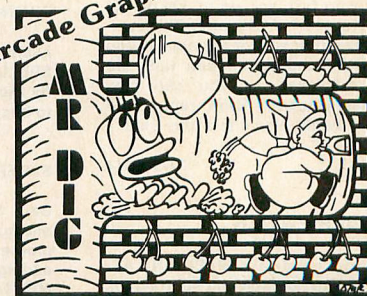
MIDDLE KINGDOM

In this real time graphics adventure set in Medieval times, your goal is to become ruler of the Middle Kingdom, which can be achieved only by returning the three Magic Rings to the Sanctuary. You must search the rooms of the Catacombs, Temple & Pyramid. Be warned! Trolls, monsters, & dangers lurk in these rooms! (Requires 32K)

Cassette \$24.95

Disk \$27.95

Arcade Graphics



MR. DIG

Cherry pickin', tunnel diggin', bad-guy chasin', fast moving fun—**DO** it all with **MR. DIG**!! Help this little wizard harvest his cherry crop by guiding him through the orchard and away from the bad hunters. If they get too close, squish them with a falling apple or bounce your magic orb their way. If you capture the extra treats you get extra points - and extra chompers that chase Mr. Dig! When all the **DIGGIN's** been **DUG**, go on to a new screen full of challenges! All the fun is in detailed hi-res color graphics & accompanied by music. Everyone who plays Mr. Dig falls in love with this cute little fella -and his game! (Requires 32K & a joystick)

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Disk \$30.95

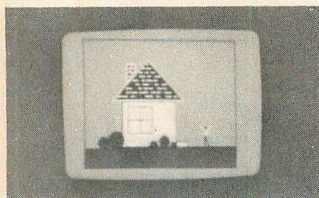


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Make your child a whiz at subtracting double-digits . . . in their head! Designed by a Mathematics teacher with an extensive background in educational psychology. Must be used with SUPERFLASH (see above).

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Learn the "Times-Tables" the EASY, EFFECTIVE way! Covers the tables

from 1 X 1, all the way through 12 X 12. Must be used with SUPERFLASH (see above).

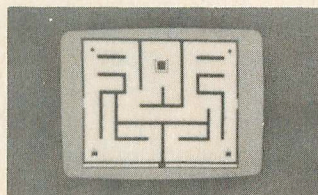
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Who ever heard of DIVISION TABLES? So many students do not do well in the higher grades because of this oversight. Must be used with SUPERFLASH (see above).

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Teaches 95 different fractional values and their equivalents in DECIMALS, FRACTIONS and PERCENT! Example: $4/5 = .8 = 80\%$. Help your child in this important area. It could even help you! Must be used with SUPERFLASH (see above).

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32K/EXT./JOYSTICKS

CASS. \$22

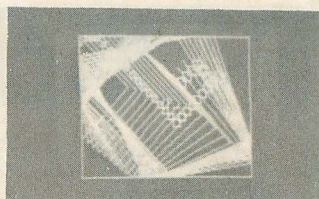
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will keep you on the edge of your seats. One or two players.

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See how fast you can streak thru the twisting, turning TIME WARP and escape to the worlds beyond. Blast those deadly ALPHA WAVES before they annihilate you! A VERY colorful and challenging game with STUNNING graphics. Never the same screen twice!

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CASS. \$14

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DISSECTING YOUR ROM

The end of the disassembly!

by Jake Commander

JAKE'S DISASSEMBLY has run for more than a year now; we have four more sections at which to look. Many requests from readers to speed things up a bit have been received. OK — we give in! Here, then, is the text describing the last four sections; with it are directions to use the disassembler Jake wrote, and the program listing of the disassembler itself. Read the text, follow the instructions, and you'll have the rest of the disassembly — fast and easy!

Section Eleven

Most uses of the Print command were covered at the end of the Color Basic part of the disassembly (Part 7). One, however, was missing — probably the most useful Print command of all — Print Using. Most of this section of disassembly is involved with this extension to the Print command.

Quite a respectable piece of code it is, too. I will freely admit, it was certainly my least favorite routine to unravel. What with working out the string specifier (as in PRINT USING "##.##*\$##") and stepping through each expression in the following variable list, it takes some understanding.

Here's a quick snapshot analysis. First the specifier string is evaluated. As with any string in Basic, it can be a variable, a quoted literal, or a mixture of both. The pointer to this string is saved as it's stepped through, because it's required to drive the format routines which follow. As each format substring is analyzed, a set of flag bits is set in memory at location \$00DA. Each bit represents a particular formatting option, such as trailing sign, asterisk-fill, exponential format, etc. This

byte is built up for each numerical expression in the list.

When the end of a recognizable substring is reached, the corresponding expression in the number list is evaluated. Finally, the evaluated number is formatted into an ASCII buffer according to the requested options. The last routines in the Print Using code concern themselves with such things as dealing with leading zeroes, placing commas where appropriate, adding asterisks and/or dollar signs — and all the time keeping track of the decimal point location. There's a lot of inline code there at the end and it's not too easy to digest. Apparently, even the original programmer got self-entangled — notice the bug in evaluating the decimal exponent at locations \$9178 and \$917C. There's the explanation of why errors occur in exponents above nine: subtracting twelves is not recommended for evaluating the tens digit!

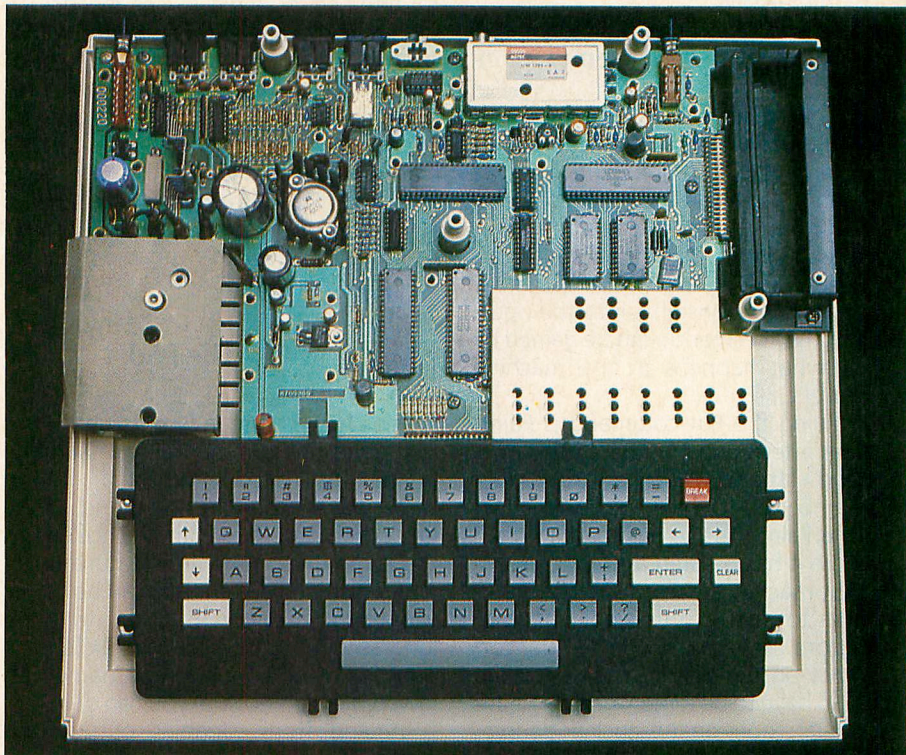
Once we're out of those dark woods, we start (at last!) with the machine code that deals with high resolution graphics.

12 — Hi Res!

High resolution graphics! It certainly took a long time to get here. To me, this is one of those most fascinating subjects, and I couldn't wait long to delve into the inner workings of this section of code. In fact, this section was disassembled and documented long before I could face routines such as RENUM and Print Using.

The code is easy to follow once you understand the many small subroutines which make up the graphics package. What tends to obfuscate the code is the different PMODEs that have to be accommodated. Things aren't too bad though; the graphic modes which are supported by Extended Color Basic all interrelate fairly well. For instance, coordinates specified for a particular graphic point can easily be transposed from one mode to another.

Last section, after the indigestible Print Using routine, the graphics code started with PSET, Preset and PPOINT. Now we'll deal with Line, PCLS, Color, PMODE,



PCLEAR, Screen, PCOPY and Get: a treasure chest of graphics code. Finally, intermingled in there somewhere is the code to deal with setting up the SAM (synchronous address multiplexer) in its dealings with the VDG (video display generator.) Although most of the graphics code is purely software oriented, this small part works right down at the hardware level. A technical reference manual is indispensable for a thorough understanding of what the code is achieving at the hardware level.

Section Thirteen

Continuing with hi-res graphics, this section starts with the Put command. Graphics saved in an array with the Get command are reinstated in video memory according to a specified option. Both the Get and Put commands are interesting to analyze. This is one of those situations where new insights into the operation of the commands can be gained by seeing what happens at the machine code level.

Following the Put command is Paint. Another interesting command, this one. It can be a little hard to follow from a raw disassembly point of view, due to the fact that the Paint routine has to keep track of where it has painted as it progresses. When it reaches any corner it has to remember to return to that point to continue from there to the border. Any corners met on the way to accomplishing that also have to be remembered. All this information goes on the stack and serves to "drive" the routine as per the shape being painted. To get the best grasp of the routine's operation, it's useful to draw a hypothetical shape and follow how the Paint routine would deal with it. This is the best way to understand any machine code routine which varies its operation according to variable parameters. And that means most machine code.

Next we encounter the Play command: sound at last! This is interesting, in that it is a "micro-interpreted" command.

The Play string has to be interpreted in much the same way as Basic itself is, and a special parse routine at \$9B98 helps achieve this.

One particularly interesting thing in the parse routine is an extremely useful feature implemented in the machine code that isn't even mentioned in my Color Computer manual. This feature lets you specify many parameters from variables. All you have to do is follow the syntax as allowed for in the string parse routine. An example to set the octave would be: `PLAY"O = X;"` where X is a variable containing the octave required. Notice the variable name must always be preceded by an equals sign and followed by a semi-colon.

It's finding goodies like this that make the chore of disassembling worthwhile. If you follow the code from \$9BBE you can decipher how this variable parameter option is allowed.

14 — The End

The Draw command starts us on the last leg of this commented disassembly. In that it's "micro-interpreted" in the same way as the Play command, Draw has a lot in common with it. Once again, the same undocumented feature exists whereby many parameters can be set by variables from within the Draw string. As long as you use the same syntax (equals sign followed by a variable name followed by a semi-colon) you can drive the command from variables outside the string.

The last command of all in the Extended Color Basic ROM is the Circle command. This is quite a speedy routine, as I found out to my chagrin. After experimenting with my own "uninterpreted" (and supposedly fast) machine code routine to draw circles, I thought my code would definitely be faster than the interpreter's.

It wasn't.

I found that I was beaten on speed but not on quality. It turns out on close scrutiny that Basic's Circle command ac-

tually draws a 64-sided polygon in close imitation of a circle, whereas my routine drew 720 dots. My circle was rounder but the interpreter's was slightly faster — an interesting trade-off between quality and speed.

Another trick the interpreter uses is that it only contains information to draw eight lines, comprising one eighth of the circle. The final circle (or arc) is built up from arcs formed by these fragments. That's eight lines each fragment which is nine pairs of start and end coordinates. These coordinates are to be found in a table from \$9E79 to \$9E9C.

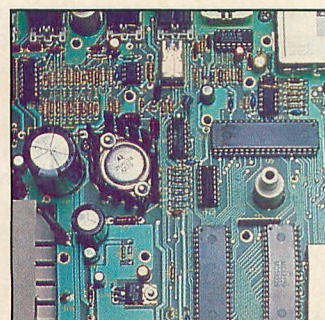
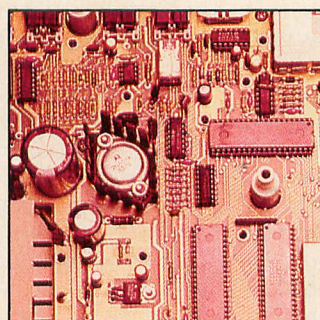
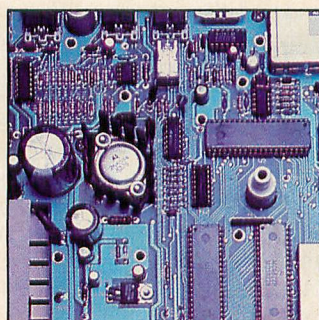
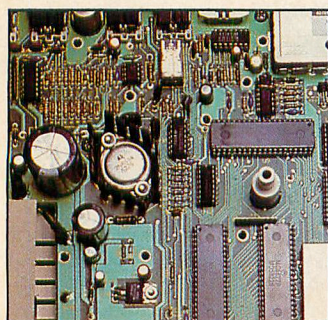
Well, I almost can't believe it, but this is the end of the journey. We've traversed the whole 16K of Extended Color Basic from start to finish and emerged unscathed. You now have the most complete User's Guide possible. If you have any questions as to the operation of any Basic command or function, just look it up in your disassembly — hopefully the answer should have been covered in enough detail that you know more than your manual will ever let on.

Most of all, I hope many readers will see how an apparently large task such as a 16K disassembly can be broken down into quite manageable parts. And once you break down the input/output drivers and interpretive code, you'll have as thorough an understanding of your machine as it's possible to get.

The Disassembler

To use the disassembler, simply Run it (RUN), and answer the first two questions with the start and end address, in hex, to disassemble. If you want the disassembly to be printed, answer the third question with Y; otherwise the listing will slowly appear on the screen. To pause you may press the shift key and the Shifted @ key simultaneously.

To pick up the disassembly where we left off at the end of part 10, use a start address of 8E37. Extended Basic ends at 9FFF. ■ ■ ■



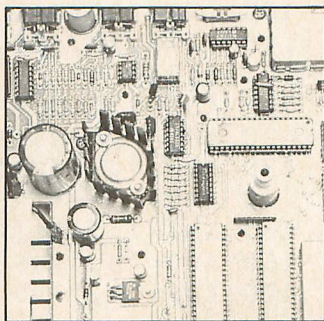
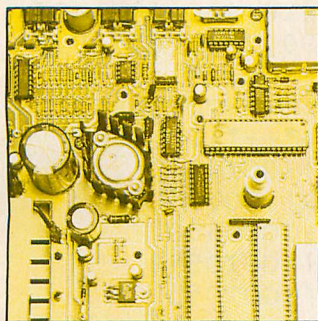
Program Listing. Disassembler

```

10 CLEAR500:CLS
20 INPUT"HEX START ADDRESS";AD$:
GOSUB990:IFT=-1THEN20ELSESA=T:OA
=T
30 INPUT"HEX END ADDRESS";AD$:GO
SUB990:IFT=-1THEN30ELSEEA=T
40 INPUT"LINE PRINT REQUIRED";Q$
:IFLEFT$(Q$,1)="Y"THENLP=1
50 DIMO1$(3),R$(11),P$(7)
60 R$(0)="D":R$(1)="X":R$(2)="Y"
:R$(3)="U":R$(4)="S":R$(5)="PC":
R$(8)="A":R$(9)="B":R$(10)="CCR"
:R$(11)="DPR"
70 P$(0)="CCR":P$(1)="A":P$(2)="
B":P$(3)="DPR":P$(4)="X":P$(5)="
Y":P$(7)="PC"
80 O0$="NEG          COMLSR   RORASR
ASLROLDEC   INCTSTJMPCLR"
90 O1$(1)="          NOP SYNC
      LBRALBSR   DAA ORCC   NDCCS
EX EXG TFR "
100 O1$(2)="LBRALBRNLBHLBLSLBHS
LBLOLBNELBEQLBVCLBVSLBPLBMLBGE
LBLTLBGTLBLE"
110 O1$(3)="LEAXLEAYLEASLEAUPSHS
PULSPSHUPULU   RTS ABX RTI CWAI
MUL      SWI "
120 O2$="SUBCMPSPBC333ANDBITLD ST
EORADCOR ADD333JSR22222"
130 PN=1
140 IFOA>EA THENENDELSELN$="":AD
$="":CM$="":O$="":DC=OA:GOSUB810
:LN$=HX$+" "
150 GOSUB950:B1=PK
160 IFPN=1THEN200ELSEX=B1 AND207
:IFPN=3THENIFB1=47THENOP$="SWI3"
:GOTO880ELSEIFX=131THENOP$="CMPU
":GOTO700ELSEIFX=140THENOP$="CMP
S":GOTO700ELSE870

```

Listing continues



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SELECT SUB-SETS of file for sorting or reporting
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```
170 IFB1=63THENOP$="SWI2":GOTO88
0ELSEIFB1>32ANDB1<48THEN220
180 IFB1=143ORB1=207THEN870ELSEI
FX=131THENOP$="CMPD"ELSEIFX=140T
HENOP$="CMPY"ELSEIFX=142THENOP$=
"LDY"ELSEIFX=143THENOP$="STY"ELS
EIFX=206THENOP$="LDS"ELSEIFX=207
THENOP$="STS"ELSE870
190 GOTO700
200 IFB1>127THEN650
210 IFB1=16ORB1=17THENPN=B1-14:G
OTO150
220 LN$=LN$+" ":IFB1<16ORB1>63TH
ENOP$=MID$(O0$, (B1 AND15)*3+1,3)
ELSEX=(B1 AND48)/16:OP$=MID$(O1$
(X), (B1 AND15)*4+1,4)
230 IFB1>127THEN650ELSEIFB1>63TH
EN610ELSEIFB1>47THEN600ELSEIFB1>
31THEN310ELSEIFB1>15THEN260
240 IFOP$=" "THEN870
250 GOSUB940:GOSUB750:AD$="<" +HX
$:GOTO880
260 ONB1-17GOTO880,880,870,870,3
30,330,870,880,270,870,270,880,3
60,360
270 IFB1=28THENOP$="ANDCC"
280 GOSUB940:GOTO300
290 GOSUB920:GOSUB800
300 GOSUB750:AD$="#" +HX$:GOTO880
310 IFPN=2THEN330ELSEOP$=RIGHT$(
OP$,3):GOSUB940:GOSUB1020
320 X=ABS(B2):GOSUB790:GOSUB750:
AD$=O$+HX$:GOSUB810:CM$=HX$:GOTO
880
330 GOSUB800:GOSUB1030
340 DC=ABS(B2):GOSUB810:GOSUB760
:AD$=O$+HX$:DC=OA+B2
350 GOSUB810:CM$=HX$:GOTO880
360 GOSUB970:GOTO880
370 GOSUB940:B1=PK:R=(PK AND96)/
32+1:IFPK>127THEN390ELSEX=PK AND
31:X=X+(X>15)*32:IFX<0THENO$="-
380 X=ABS(X):GOSUB790:GOSUB750:A
D$=O$+HX$+" "+R$(R):GOTO880
390 T=PK AND15:IFT=7ORT=10ORT=14
THEN870ELSEIFT=12ORT=13THENR=5
400 ONT+1GOTO410,420,430,440,450
,460,470,20,480,490,20,510,520,5
30,20,540
410 AD$=" "+R$(R)+"+":GOTO880
420 AD$=" "+R$(R)+"+":GOTO550
430 AD$=" "-R$(R):GOTO880
440 AD$=" --"+R$(R):GOTO550
450 AD$=" "+R$(R):GOTO550
460 AD$="B "+R$(R):GOTO550
470 AD$="A "+R$(R):GOTO550
```



```

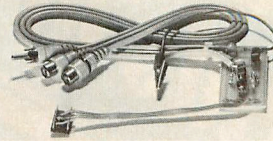
480 GOSUB950:GOSUB1020:X=ABS(B2)
:GOSUB790:GOTO500
490 GOSUB800:GOSUB1030:DC=ABS(B2)
):GOSUB810
500 GOSUB750:AD$=O$+HX$+"", "+R$(R)
):GOTO550
510 AD$="D", "+R$(R):GOTO550
520 R=5:GOTO480
530 R=5:GOTO490
540 GOSUB800:AD$="[ "+HX$+" ]":GOT
O880
550 IF(B1 AND16)=0THEN880ELSEAD$
="[ "+AD$+" ]":GOTO880
560 IFRIGHT$(OP$,1)="S"THENP$(6)
="U"ELSEP$(6)="S"
570 GOSUB940:FORY=0TO7:PK=INT(PK
)/2:IFPK=INT(PK)THENNEXTELSEAD$=
AD$+P$(Y)+"", ":NEXT
580 IFLEN(AD$)<>0THENAD$=LEFT$(A
D$,LEN(AD$)-1)
590 GOTO880
600 IFB1<52THEN370ELSEIFB1<56THE
N560ELSEONB1-55GOTO870,880,880,8
80,280,880,870,880
610 X=(B1 AND48)/16:IFOP$=" "O
ROP$="JMP"ANDX<2THEN870ELSEONX+1
GOTO630,640,370
620 GOSUB920:GOSUB800:GOSUB760:A
D$=HX$:GOTO880
630 OP$=OP$+"A":GOTO880
640 OP$=OP$+"B":GOTO880
650 IFB1=135ORB1=143ORB1=199ORB1
=205ORB1=207THEN870ELSEX=B1 AND1
43-128:OP$=MID$(O2$,X*3+1,3):IFR
IGHT$(OP$,1)=" "THENOP$=LEFT$(OP
$,2)
660 X=B1 AND15:IFX<12ANDX<>3THEN
IFB1>191THENOP$=OP$+"B":GOTO700E
LSEOP$=OP$+"A":GOTO700
670 IFB1>191THEN690ELSEIFX=3THEN
OP$="SUBD"ELSEIFX=12THENOP$="CMP
X"ELSEIFX=14THENOP$="LDX"ELSEIFX
=15THENOP$="STX"ELSEIFB1=141THEN
OP$="BSR":GOTO310
680 GOTO700
690 IFX=3THENOP$="ADDD"ELSEIFX=1
2THENOP$="LDD"ELSEIFX=13THENOP$=
"STD"ELSEIFX=14THENOP$="LDU"ELSE
IFX=15THENOP$="STU"
700 X=(PK AND48)/16:ON4-X GOTO62
0,370,250
710 X=PK AND15:IFX=3ORX>11THEN29
0ELSE280
720 LN$=LN$+HX$:IFB1<63THEN730EL
SEIFB1=63THENOP$="SWI2"ELSEX=B1A
ND79:IFX=3THENOP$="CMPD"ELSEIFX=

```

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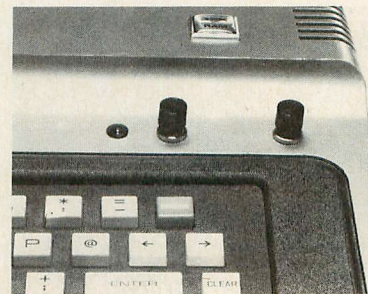
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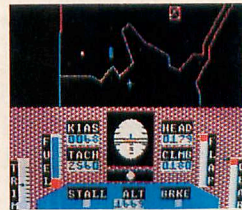
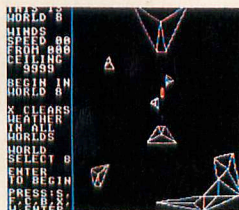
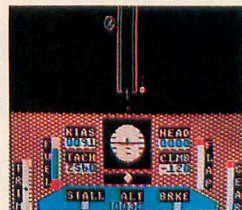
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12THENOP$="CMPY"ELSEIFX=14THENOP
$="LDY"ELSEIFX=15THENOP$="STY"EL
SEIFX=78THENOP$="LDS"ELSEIFX=79T
HENOP$="STS"ELSE880
730 IFX<17ORX>47ORX=52ORX=53THEN
OP$="":GOTO880ELSEOP$="L"+OP$
740 LN$=LN$+HX$:IFB1=63THENOP$="
SWI3"ELSEX=B1AND79:IFX=3THENOP$=
"CMPU"ELSEIFX=12THENOP$="CMPS"EL
SE880
750 IFLEN(HX$)=2THENIFHX$<"0A"TH
EN780ELSE770
760 IFHX$<"000A"THEN780
770 HX$="$"+HX$:RETURN
780 HX$=RIGHT$(HX$,1):RETURN
790 HX$="":GOTO830
800 GOSUB950:B2=PK:GOSUB950:DC=B
2*256+PK
810 HX$="":HB=INT(DC/256):LB=DC-
HB*256
820 X=HB:GOSUB830:X=LB
830 Y=INT(X/16):IFY>9THENY=Y+7
840 HX$=HX$+CHR$(Y+48)
850 X=X-INT(X/16)*16:IFX>9THENX=
X+7
860 HX$=HX$+CHR$(X+48):RETURN
870 OP$="":AD$=""
880 LN$=LN$+STRING$(15-LEN(LN$),
32)+OP$
890 LN$=LN$+STRING$(20-LEN(LN$),
32)+AD$
900 IFCM$<>"":THENLN$=LN$+STRING$
(27-LEN(LN$),32)+CM$
910 IFLP=1THENPRINT#-2,LN$:GOTO1
30ELSEPRINTLN$:GOTO130
920 L=LEN(LN$):IFL<9THENL=8
930 LN$=LN$+STRING$(L-LEN(LN$),3
2):RETURN
940 GOSUB920
950 GOSUB960:X=PK:GOSUB790:LN$=L
N$+HX$:RETURN
960 PK=PEEK(OA):OA=OA+1:RETURN
970 GOSUB940:X=(PK AND240)/16:GO
SUB980:AD$=AD$+",":X=PK AND15
980 IFX>11THEN870ELSEIFR$(X)="":T
HEN870ELSEAD$=AD$+R$(X):RETURN
990 T=0:FORX=1TOLEN(AD$):Y=ASC(M
ID$(AD$,X,1)):IFY<48ORY>70OR(Y<6
5ANDY>57)THENT=-1:RETURN
1000 Y=Y-48:IFY>9THENY=Y-7
1010 T=T*16+Y:NEXT:RETURN
1020 B2=PK+(PK>127)*256:DC=OA+B2
:GOTO1040
1030 B2=DC+(DC>32767)*65536
1040 IFB2<0THENO$="-":RETURNELSE
RETURN

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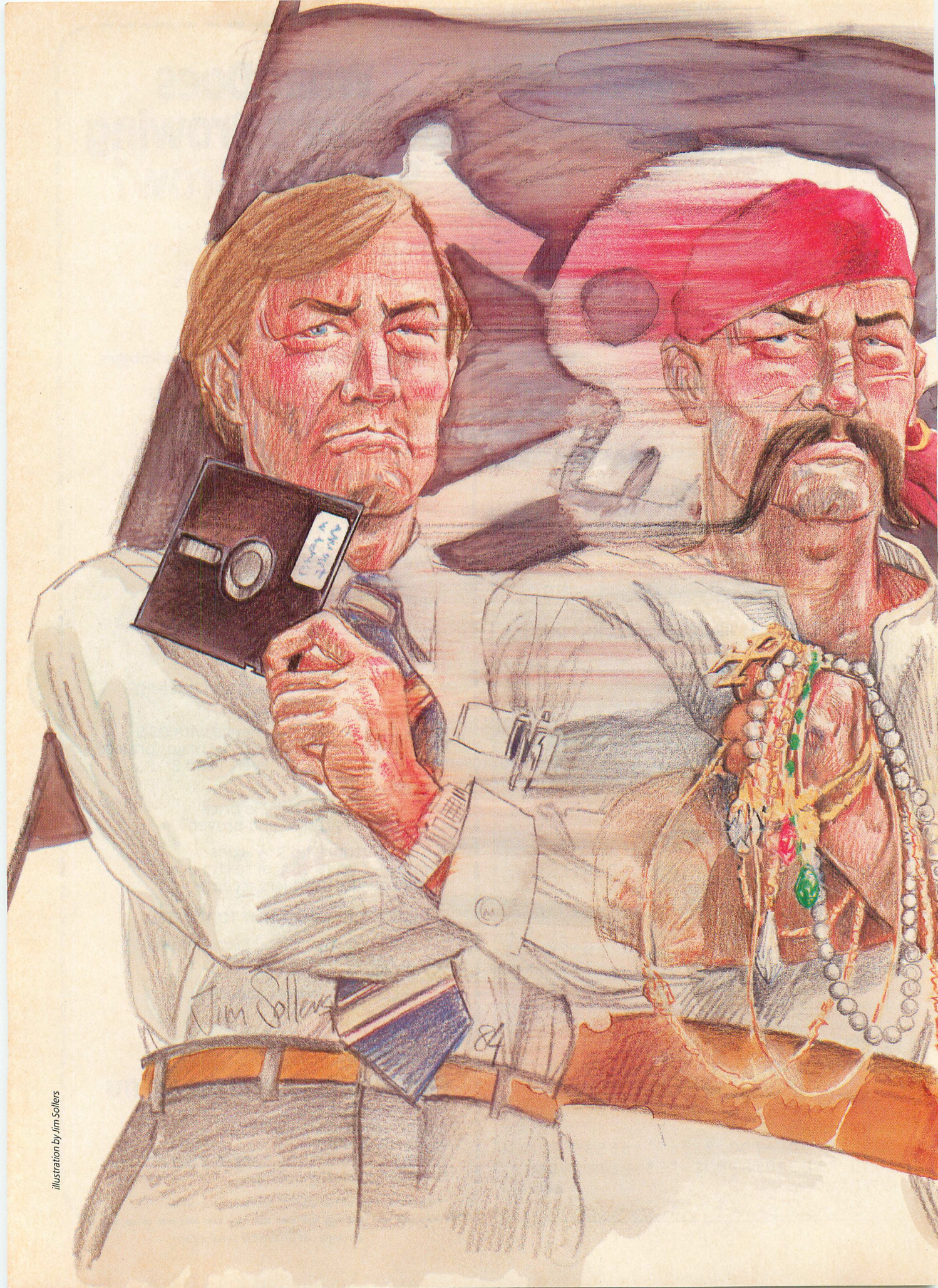
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A detailed illustration on the left side of the page shows a pirate's hand in a red sleeve holding a wooden-handled pistol. Below the hand is a small, ornate treasure chest. The background of the illustration is a mix of purple, blue, and red washes.

Color Computing for Kids

We take a look at a serious subject — software piracy.

by Jean Plessner

RATHER THAN PRESENT a programming lesson this month, I've decided to call your attention to a serious problem that affects all computer software users. *Software piracy* is the illegal copying and sharing of copyrighted software; it affects everyone who buys or sells computer software.

Software is the term used for programs available on cassette tapes, ROM-paks, disks, or in magazines. *Piracy* is a term used to describe the act of theft, or stealing. *Copyrighted* software means someone has legally protected the software against copying by anyone, other than for limited reproduction for such purposes as critical commentary (in reviews), news reporting, and educational use, presumably by teachers in a classroom setting.

I've chosen July to talk about software piracy because it's the anniversary of Independence Day. It's a time that all of us feel especially proud of our country and the *integrity* (honesty) that has been the backbone of America. On July 4 we look forward to celebrations that may include picnics, parades, contests, games, lots of good food and, almost certainly, fireworks. The booming, blasting explosions of the fireworks are a reminder of America's protection of freedom. The Declaration of Independence declared our freedom from British rule, and America later adopted the Constitution and Bill of

Rights to continue to protect the rights and freedom of every American. Software piracy is an insult to our integrity and a violation of human rights.

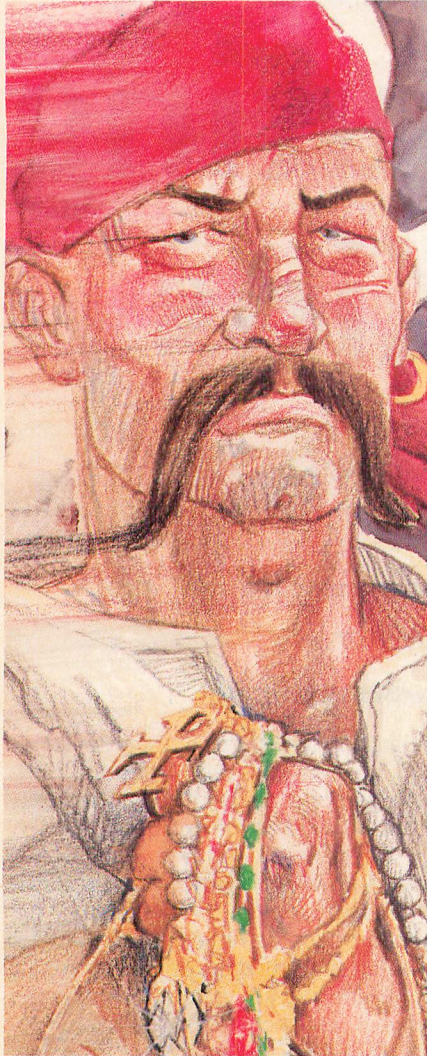
As responsible citizens, we observe laws and work together to protect the rights and property of all. We enjoy our freedoms, sometimes even take them for granted, but because we have so many rights and liberties we often don't know when a seemingly harmless action is really a violation of someone else's rights. Software piracy can be such an act, and all of us, working together, can make a difference by protecting the rights of others and ultimately our own freedoms.

The Pirate's Tale

We picture pirates from the movies we've seen and books we've enjoyed. They wear large hats or turbans, shiny boots (or boot if it's a peg-legged pirate), gold earrings pierce their ears, and a sword or dagger is never far from hand. Pirates sail the seas in search of treasure and adventure. They drink rum and sing humorous drunken songs. They seem to always be having a great time and we can easily get caught up in their glorified adventures.

But, the truth is, traditional pirates were sea robbers. They were thieves who thrived on stealing property belonging to others. They stole and shared goods that

the rightful owners depended on for their livelihood. Pirates' treasures were other people's losses, and sometimes these thefts destroyed a person's ability to live without help from neighbors.



tion and a fee for registration to the United States Copyright Office in Washington, D.C. Another way is to put the words "Copyright 19— by XXX" somewhere on the work or package. These words are often replaced by the copyright symbol (©) followed by the date. See if you can find a copyright notice on a piece of software you purchased.

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Figure 1. Examples of copyright notices or marks that may appear on software.

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*Figure 2. This is a copy of the copyright notice that appears in **The Color Computer Magazine**, protecting all the articles and programs in it from illegal copying. You will find a similar notice in most magazines.*

Pirates may seem unreal, tucked away in literature or movie reels, and hardly able to affect our daily lives. There is a modern-day pirate, however, that is just as menacing. Software pirates copy, with intent to share and sometimes sell, programs that have been copyrighted by others. This means they are stealing material that belongs to someone else as well as violating the rights of another. Now you know why the term *pirate* is used to describe software thieves.

What Is a Copyright?

Copyright technically means, "right to copy." When a person creates or writes something for public use or enjoyment, the person can protect his or her right to own and control it. This is done in several ways. A common way is by sending copies, or pictures, of the work with an applica-

device is not piracy if you do not record from someone else's copy or sell, rent, lease, or loan your copy to anyone.

Copyrighted material is printed with a copyright symbol or statement. Of course, a *copy* of a copyrighted work will probably not have this information — but the work is still protected, and must be considered the same as the original.

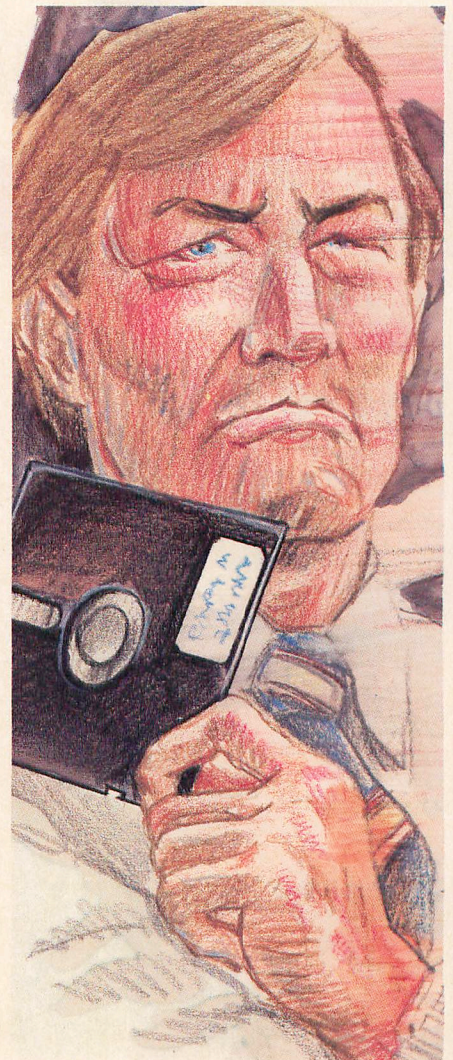
Why Copyright?

Computer programmers, like writers and artists, use their knowledge and talent to make significant contributions to society. Their programs help solve problems, save time, help us become more efficient and organized, as well as teach and entertain us.

Computer software has perhaps caused more significant changes in our society than anything since paper and pencil.

We want it, need it, and continually demand more. With the help of computers and expert software, businesses save money and time, schools save money and can teach more effectively, hospitals and other public service facilities save money and provide more efficient services, and many, many other organizations benefit in time- and money-saving ways. Let's not forget the millions of personal computers found in homes throughout the world creating a need for money-saving, time-saving, creative, challenging, and entertaining software.

Did you notice how many times I used the word *money* when I talked about software? The word occurred often because software is a serious business made up of many individual businesses, both small and large. That means there are many, many people who work in the



software industry, just as they do in any other industry, and each of these people need to earn salaries that support themselves and their families. All the way from the computer programmer to the software packager, there are families like

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yours who depend on the income received from the sale of copyrighted software.

When a business successfully sells a product they are able to produce more of the product. This act alone can support many other businesses and many other people. When businesses and individuals earn money they pay taxes on their earnings or profits, and this keeps our government functioning and working for us. If a business fails, everyone connected with the business is affected. The materials and products it once needed are no longer in demand; all the people who worked to supply the products or services needed by the business are now out of work; and the state, local and federal governments experience a loss in tax revenue. Think of dominoes when they are set up in a row: knock over the first and one after another they all fall down. This can be the case in business when companies fail.

Copyrights are just one of the safeguards a software business takes in an effort to protect their investments and their future. Another safeguard is a special code included in a program so that a listing cannot easily be copied. Both safeguards are used to keep the consumer from violating the copyright and, ultimately, jeopardizing the future of the software business when one copy can become ten, fifty, or even hundreds of copies for each one sold.

When a pirate breaks a protection code and places a game or other piece of software on a BBS (computer Bulletin Board Service) for users to copy, it hurts everyone. Software businesses are reluctant to buy software licenses for the arcade games you and I most want to own for our Color Computers and to spend the large amounts of money required to reproduce such games. Who suffers most in the end? You and I. Why? Because software pirates steal more than programs. They rob us all of our rights to free enterprise and total enjoyment of our investments — business or personal.

You Can Make A Difference

We all like to get something for nothing. *Free* is like a magic word that attracts people to things they wouldn't normally be interested in, but free isn't usually free. Someone is paying somewhere along the line, and it's usually you. The price of related items may become higher or quality may suffer, and both can be the case where "free" means "pirated software."

If software piracy isn't eliminated you will eventually pay much more for soft-

ware and have much less available. There will be fewer people willing to invest their time and money in something so risky, and you and I will be left with computers that are no longer serving our needs and expectations. But we can all help by understanding and approaching piracy maturely and responsibly.

It's very hard to turn something down that you can get for nothing — especially something you want and something a lot of other people are taking. It may even seem really dumb to then turn around and purchase the same thing you could have had for free. But, when you remember that someone's job or security may be affected by your action, it seems even more dumb not to. I know you would see my point even more clearly if we were talking about the security or future career of someone you care about, so if it helps, think of it in just that way. We may even be talking about *your* future. What career do you hope to work in some day? Will computers be involved? My guess is probably yes and I also wonder if copyright violators won't have an effect on you too.

Regardless of whether we have personal reasons for wanting protection or copyright laws, our main concern should simply be in the protection of our freedoms as Americans. We as individuals have that responsibility, and creating and following our consciences is perhaps the best protection for all our rights. So, the next time you're tempted with pirated software, listen to your conscience — it's wrong and it can hurt others. Spread the word. Please.

Then Why Does It Cost So Much?

Computer software is not really something you can hold in your hand and immediately decide its value. You're not actually buying a cassette tape or a disk, but rather the program recorded on it, so the price of each software package may vary greatly. The price is determined by many factors, as we'll see in our next article. I've visited a software business and I'll share what I've learned with you as we follow a piece of software from the programmer's mind to the store's display rack.

We'll look at the roles of the many people involved and at the costs of producing quality software. I learned a lot of things that give software a value beyond the store price tag, and I'm anxious to share them with you.

Join me as I take you where no software pirate has dared to go and innocently continue to violate the rights of the software industry. ■ ■ ■

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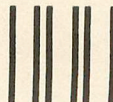
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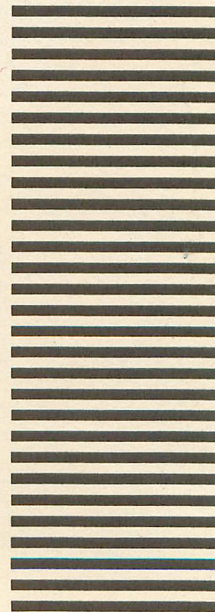
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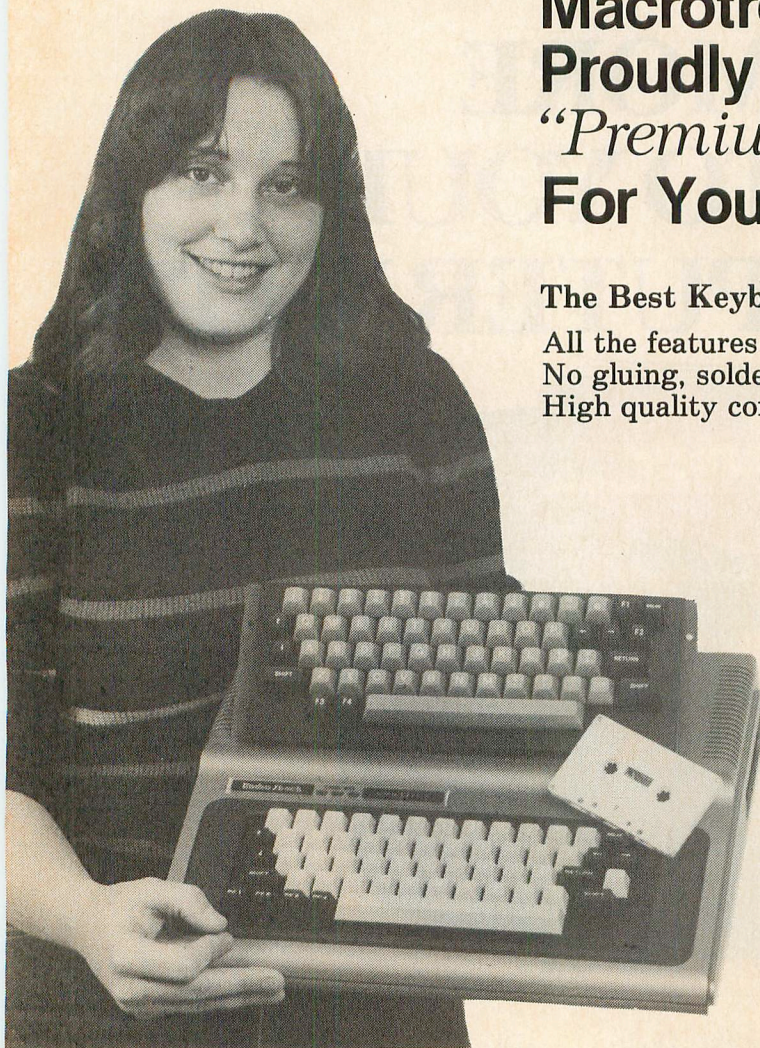
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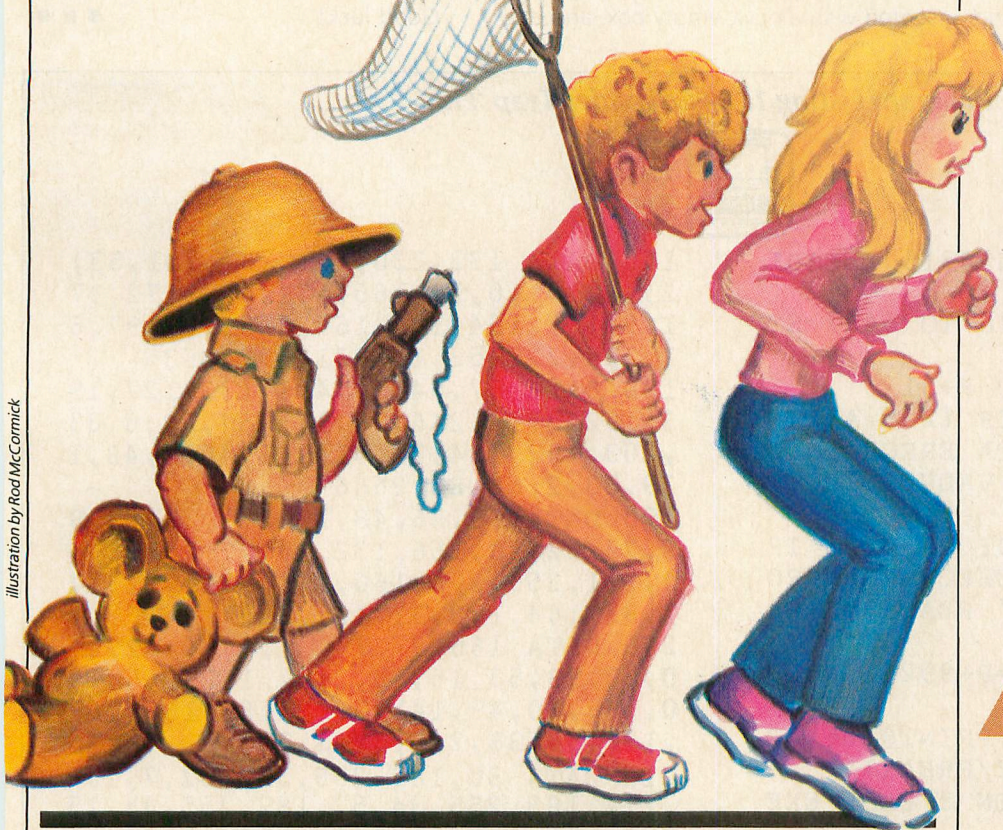
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Circle No. 149 on Reader Service Card

Summer Programming Project



The Very Last Winner!

TRAP 'EM, BY MATTHEW Cimbala, is the Second Runner Up in the assembly language category of The Summer Programming Project. Trap 'Em takes a quick eye, a quick hand, and enough bravado to try the impossible, in order to win. High scores are not made by the prudent among us.

To load Trap 'Em, first enter the Basic Loader (Listing 1) and CSAVE it. Then type RUN. If you get an ?FC ERROR message the first time you do this, don't panic — graphics memory where the game is placed simply wasn't set. Just enter RUN again. If there are any errors, the loader will now inform you what lines they are in. Make your corrections — you'll know they are all fixed when the ARE YOU READY? prompt appears when you run the loader. Press Break and save the corrected Basic loader (with CSAVE), and then save the game itself with: CSAVE "TRAPEM", 2048, 5407, 2048. To run the game from tape: CLOADM:EXEC and press Enter. Alternatively, you can press Y in response to the

original READY? prompt to play immediately from the loader (warning — the Basic loader is lost when you use this method and you won't be able to play again without re-entering the loader by hand. The first method is preferable).

The Game

The game starts with four balls bouncing inside a large green box. Using the left joystick, you move a marker along the edges of the box. The object of the game is to cause each ball to bounce at least 100 times in the first 100 seconds of play. You do this by building new walls off the original box, into the play area: point the joystick in the direction you wish to create a wall, and hold the fire button down to move the marker in that direction. The marker will draw a new wall (in blue) in that direction until you release the fire button or hit a green wall. Hitting a green wall makes your new, blue wall permanent, and it turns green.

T
R
A
P
'
E
M

Releasing the fire button doesn't make a wall permanent! Trapping balls inside smaller boxes makes them bounce faster, adding to your score. There is a catch, however: if a ball bounces against a blue (incomplete) wall, you lose the wall and

your marker (you have only three markers per game).

A timer keeps track of seconds ticking by. If the balls have bounced at least 100 times in the 100 seconds, you are presented with a new, empty box, and one

ball is added. This may continue until you have a total of 10 balls in the box.

Pressing Break at any time clears the score and starts the game over with four balls.

Good luck!

■ ■ ■

Program Listing 1. Basic Loader Trap 'Em



16K
Color
Basic

```
0 PCLEAR4: CLS: PRINT@315,"LOADI
NG TRAP'EM"
2 LN=100: FOR P= 2048 TO 5407 ST
EP 32: PRINT@205,LN
3 CK=0: FOR AD= P TO P+31
4 READ B: CK=CK+B: IF (255 AND B
)<>B THEN PRINT" DATA ERROR IN L
INE"LN: PRINT" BYTE VALUE"B"NOT
ALLOWED": STOP
5 POKE AD,B: NEXT AD: READ B: IF
CK<>B THEN PRINT" CHECKSUM ERRO
R IN LINE"LN: PRINT" READ:"B" CA
LC'D:"CK: STOP
6 IF P= 4096 THEN P=P+992: LN=LN
+310
7 LN=LN+10: NEXT P: PRINT@386,"R
EADY FOR TRAP'EM? (Y/BREAK)"
8 IF INKEY$<>"Y" THEN 8 ELSE EXE
C 2048
100 DATA 16,255,21,19,15,111,95,
134,32,173,159,160,2,90,38,249,1
73,159,160,2,90,38,249,48,141,11
,250,204,20,156,131,20,3421
110 DATA 21,166,128,173,159,160,
2,90,38,247,142,8,0,191,20,157,1
41,12,173,159,160,0,39,248,22,1,
110,22,1,107,52,16,2965
120 DATA 190,20,157,48,1,140,16,
18,37,3,142,8,0,191,20,157,134,2
,109,132,42,1,64,53,144,52,54,49
,141,0,28,198,2351
130 DATA 7,61,49,171,198,7,52,4,
166,160,246,20,170,61,231,132,48
,136,32,106,228,38,241,53,4,53,1
82,21,17,17,17,17,2945
140 DATA 17,21,4,20,4,4,4,4,21,2
1,17,1,21,16,16,21,21,1,1,5,1,1,
21,17,17,17,21,1,1,1,21,16,375
150 DATA 16,21,1,17,21,21,17,16,
21,17,17,21,21,17,1,1,1,1,1,21,1
7,17,21,17,17,21,21,17,17,21,1,1
7,474
160 DATA 21,132,127,52,2,83,203,
192,134,32,61,142,40,0,48,139,53
,2,68,86,68,86,48,134,79,88,73,8
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```

```
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,203,192,134,32,61,142,40,0,48,1
39,53,2,68,86,2666
190 DATA 68,86,48,134,79,88,73,8
8,73,52,18,166,132,167,99,53,2,4
8,141,255,204,166,134,52,3,72,17
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200 DATA 166,97,70,37,3,86,32,25
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,134,90,38,249,32,3120
210 DATA 30,182,255,35,132,7,138
,224,183,255,34,57,182,255,35,13
2,7,138,232,32,243,8,10,13,14,17
,18,20,2,5,7,141,3043
220 DATA 224,142,40,0,182,20,178
,52,2,72,72,170,228,72,72,170,22
8,72,72,170,224,167,128,140,63,0
,37,7,125,20,201,39,3389
230 DATA 7,111,31,140,64,0,37,23
7,57,198,3,247,20,199,247,21,15,
247,20,201,127,20,166,16,254,21,
19,127,20,165,127,20,3184
240 DATA 164,127,20,163,127,20,1
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250 DATA 21,29,23,255,106,127,20
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270 DATA 246,20,196,90,52,4,39,1
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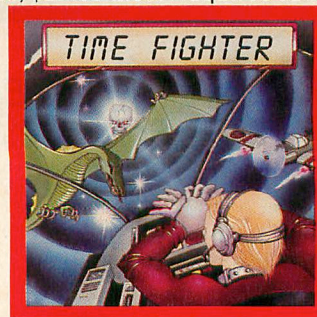

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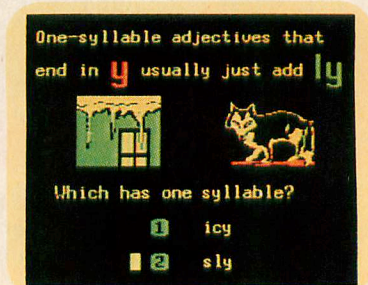
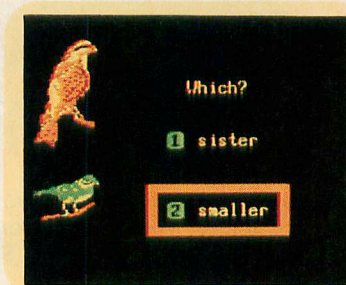
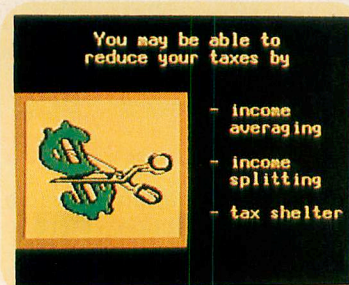
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 ,251,183,255,2,182,255,0,132,64,
 16,39,252,94,246,21,23,4159

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410 DATA 90,38,253,134,128,112,2
 0,200,42,1,79,183,255,32,13,142,
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 540 DATA 52,2,72,171,224,171,224
 ,253,20,187,51,141,7,64,23,0,159

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,246,20,178,247,20,170,246,20,17
6,247,20,191,252,20,204,4078
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 ,0,0,0,0,0,0,0,0,0,0,0,0,1570
 1060 DATA 0,0,0,0,0,0,0,0,0,0,0,0,
 0,0,0,0,0,0,0,0,0,0,32,32,32,32,
 32,32,32,32,32,32,84,404
 1070 DATA 82,65,80,39,69,77,13,1
 3,32,32,32,32,32,32,32,32,32,32,
 32,32,32,32,32,32,32,32,32,32,
 ,32,32,32,1206
 1080 DATA 13,32,32,32,32,32,66,8
 9,32,77,65,84,84,72,69,87,32,71,
 32,67,73,77,66,65,76,65,13,13,32
 ,32,80,82,1774
 1090 DATA 69,83,83,32,65,78,89,3
 2,75,69,89,32,84,79,32,83,84,65,
 82,84,32,71,65,77,69,13,32,80,82
 ,69,83,83,2145
 1100 DATA 32,34,66,82,69,65,75,3
 4,32,84,79,32,82,69,83,84,65,82,
 84,32,71,65,77,69,13,13,13,13,13
 ,0,0,0,1612
 1110 DATA 0,0,0,0,0,0,0,0,0,0,0,0,
 0,0,0,0,2,0,1,3,2,0,1,0,0,0,0,0,
 0,0,0,0,0,9
 1120 DATA 0,0,0,0,0,0,0,0,0,0,0,0,
 2,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
 0,0,0,0,0,2
 1130 DATA 0,0,0,0,0,0,0,0,0,0,0,0,
 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
 0,0,0,0,0,0
 1140 DATA 0,0,0,0,0,0,0,0,0,0,0,0,
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 0,0,0,0,0,0

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ON- LINE

by Terry Kepner

WE LAST COVERED SIG databases, but didn't mention one important one: the X database, an information-only section available in each SIG database. At any SIG Function prompt, when you enter x_n , (where n is a number from 0 to 11) the database will automatically begin listing everything in it to your computer. These X databases are set up by each SIG's Sysop, and only *he* can put information in them. They are used to tell users about the system. For example, x_5 in the Model 100 SIG gives a brief explanation of the database commands and how to use them. Newcomers are told to download this section when they have questions about use of the databases. Another SIG Sysop uses an X database to explain how to retrieve and leave messages. The Sysop generally tells you which X databases are enabled for that SIG when you sign on as a first-time user.

The control codes used in the BBS section of the SIG also work in the database section: Control A stops output with the current line; Control C aborts the listing in progress; Control S pauses the listing; Control Q resumes listing after a Control S; and Control P returns you to the database prompt.

User Command Mode

Now that you know how to maneuver around the SIG, and know your options,

you can get rid of repetitive menus and long-winded prompts by using the advanced user command mode. This mode assumes you've memorized all functions, menus, and prompts in the SIG. You receive short and concise messages instead of long multiple choice menus; you also have many other options.

To select this mode, select Option 9 of the main SIG Function menu. You'll then be given a second menu, listing four choices: change to advanced command mode; change terminal line length L ; return to Function prompt or menu T ; and make these changes permanent P .

The second option is a quick and easy way to change your terminal line length parameter without leaving the SIG and going to CIS-4. Option three takes you out of the option-setting section of the SIG and back to using it. Option four is self-explanatory. Option one is what we will explore.

When you select option one, a list of possible options is displayed (see The User Options list). Your current option settings are indicated by an asterisk or a number following the option. Only some options require a number, such as line length, default log-in section, and number of lines on your display page. This is the only section that will put multiple commands on one line, which is a time-saving feature since otherwise the entire list of options is printed every time you press Enter.

The *default* settings are ST (stop and send a prompt after each message listed), $LL64$ (line length is 64 characters), NPG (don't break the messages into pages, scroll continuously until the end of the message is reached), NB (don't abbreviate the prompts), MWM (mark any messages addressed to you), and RNT (read new command, list all messages, including those left by you).

This is the only section that will put multiple commands on one line, which is a time-saving feature since otherwise the entire list of options is printed every time you press Enter.

First set the line length to 32 (if it isn't already): $LL32$. Next, set the messages to non-stop mode: NS . This means the SIG won't stop after every message to ask if you want to continue, reply to the message, or return to the Function prompt or menu. This will save you time, and therefore, money. The disadvantage is that you can't stop the scroll and send a reply. (When you abort the message scroll you return to the Function prompt, so if you want to reply to a message you must select that message via the RI command, which asks, after displaying the message, if you want to reply.) The only time the scroll stops is when a message addressed to you is reached. You are then asked if you want to continue, reply, return, or delete the message.

BR stops repetitious displays of options. To make these changes permanent (you won't have to set them every time you access the SIG) type P . Making these changes one at a time wastes time, since user options are redisplayed each time. Use multiple commands; to set non-stop mode, 32 character line length, stop repetitious display, and set permanent changes, type $NS;LL32;BR;P$. When the user option list is displayed, check to see that all the options you selected were indeed changed.

More Options

These are not all your options. To organize your screens into 16-line pages, use the PG option. The PG option requires that the ST (stop between messages) option also be selected. To automatically skip messages you left when you would use the RN command to read new messages, use the RNS option command. If you don't like the prompt character used by the SIG, change it with the PC option command. If you want messages left for you to automatically and immediately be typed out when you sign on, use the TWM option command. Other options are listed in the Advanced Options list.

Illustration by Rod McCormick



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Dolan	188	157	103	112	161	122	99	145	145	103					188	97
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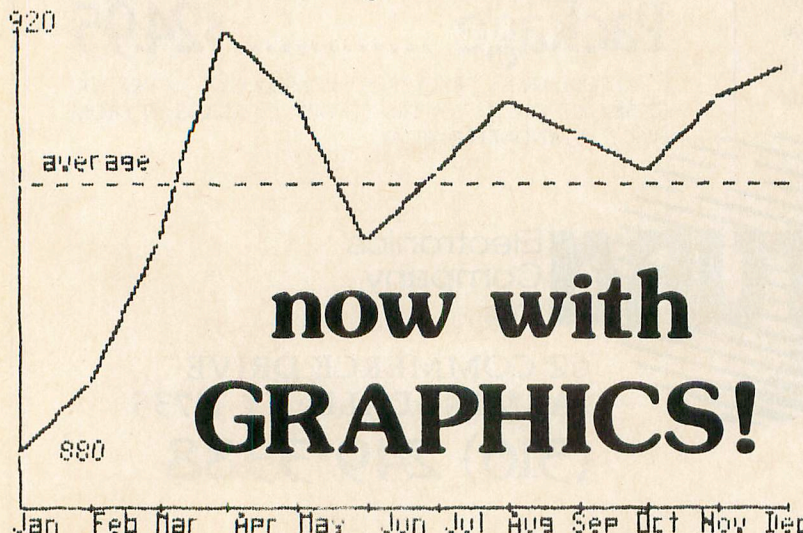
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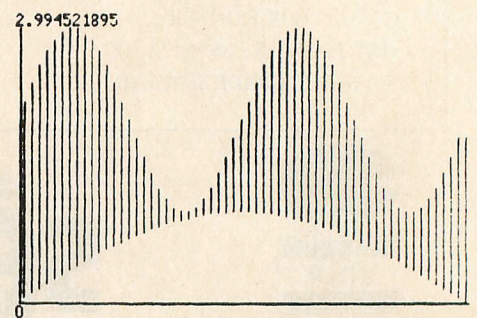
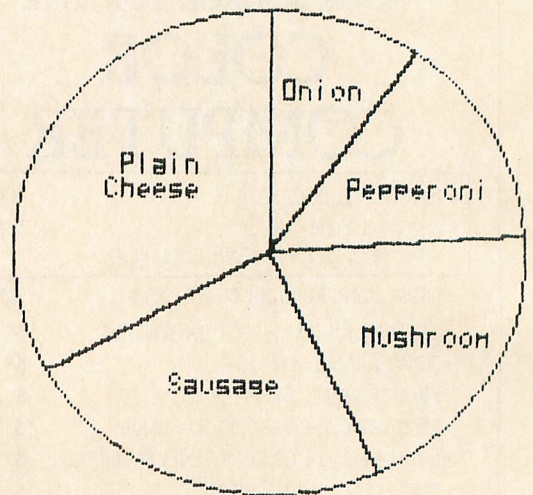
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After making permanent changes, issue the command T to return to the Function prompt, which is all you'll see: the menu has been suppressed.

Be careful with these options; it's easy to get confused and lost. One item that'll help is the "SIG'er REF" reference card from Interpro (P.O. Box 4211, Manchester, NH, 03108, \$5.85), which lists SIG commands, their syntax, and useful information about the SIGs.

Congratulations, now you're a professional SIG user; you can easily and quickly move from one area to another, getting the most information possible, and wasting little time wondering what to do and how to do it!

EMAIL

Now let's explore the EMAIL service. Leaving messages on the SIG BBS is easy if you know they'll be on the service before the message has a chance to scroll off. But if the action is fast and furious, as it is on some SIGs, you'd have to sign on every three or four days not to miss any messages. And what if the recipient of the message isn't a member of the same SIG as you are? EMAIL to the rescue!

EMAIL is an electronic mail service available to CompuServe members. To use EMAIL, just go to the EMAIL section of CompuServe and address and compose your message. That's it: in actual execution, the procedure is a bit more complex.

To get to the EMAIL section, type GO EMA. When you get to page one (EMA-1), you have two choices: read mail, or compose and send mail.

To read mail, select option one and

*"Leaving messages is
easy unless the action
is fast and furious:
EMAIL to the rescue!"*

you'll be given a numbered list of people who've sent you EMAIL messages since the last time you read your mail. (By the way, when people send you EMAIL, CompuServe gives a brief notice EMAIL is waiting when you next sign on.) Select the message you want to read and get ready for the message's transmission. After the message is displayed you can re-read the message, save it to your per-

sonal programming disk space, or have it erased from your EMAIL mailbox and your disk space.

Composing and sending a message is more difficult. All messages require the PPN number (CompuServe user ID number) of the recipient. If you only know the person's name, you'll have to check the user database in the Public Access section and see if the person has left his name and PPN in the files.

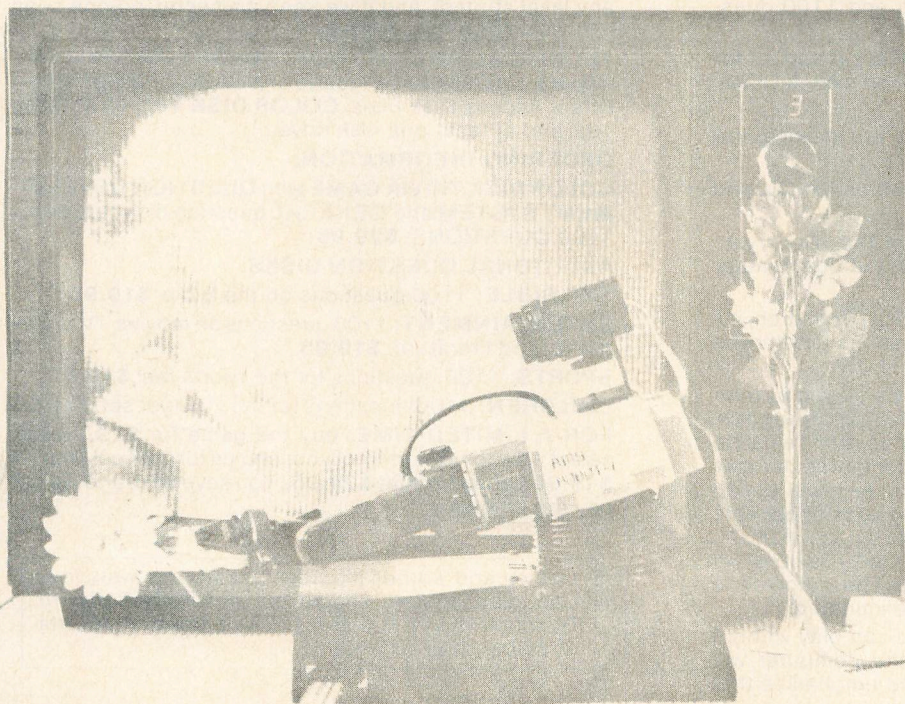
Armed with the recipient's PPN, you're ready to compose your message. Select option 2 from page EMA-1 to take you to page EMA-4. EMA-4 lists eight options: the first three create messages; the next two edit messages; the sixth places your message in the recipient's EMAIL box for delivery; and the last two lead to help sections on the two text editors available in EMAIL.

Procedures

The first three options create a message file and are used with the Filge file editor or the ICS file editor, or by copying it from your disk space in the Personal Programming Area.

The Filge text editor is line oriented: your file is treated as a series of discrete

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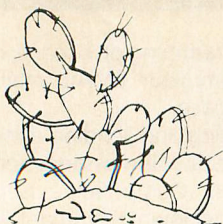
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GENERAL: (Included with the game) The categories for this disk are history, the written word, movies & television, science & the world, and sports.

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The game of **COLOR DISK TRIVIA** can be played by from 1 to 4 people (or teams), and you set the length of the game at the start when you decide how many questions must be answered in each category to win. The computer chooses the categories randomly, though sometimes it will let you choose the category for yourself (or let your opponents choose for you). Because of this category selection by the computer, a single category can often hold you up while one of your opponents slips by to win. The outcome is always in doubt, and no player is ever eliminated.

Trivia lovers will enjoy the fact that you can play without other people if you desire, because the computer will provide plenty of challenge. We want to emphasize that this is, first and foremost, a fun game.

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The Development System

Naturally, in order for our programmers to type in thousands of questions easily and accurately, a good development program to create the question disks had to be written, and we include this program with the game at no additional charge!

The program is all menu-driven and very user-friendly. That means that no knowledge of programming is needed to use it. If you can turn on your computer and type, you're all set! Now sit back and imagine the educational possibilities.

Yes, our question disks have 1100 questions, but the game program will handle question disks having any number of questions from 5 up to a full disk of 1100, so a teacher can type in 50 or 100 questions and answers (the questions are multiple choice), and then the students can play the "game" and have a great time, while accidentally picking up the lesson. Let the natural spirit of competition fuel the learning process.

The development program is very easy to use, and gives you options to add questions, change or delete a question, and print the questions and answers on the screen (or a printer, if you have one). You can develop a question disk and easily add questions to it any time you wish.

This program finally gives parents and teachers the opportunity to easily create a custom learning program for any level student, and if we keep it a secret, no-one need know it's more than a game.

TECHNICAL INFORMATION: **COLOR DISK TRIVIA** is a mixture of Machine Language and BASIC. It uses Fielded Direct Access Disk Files. **COLOR DISK TRIVIA** requires 16K and at least one disk drive.

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un-numbered lines. Use Filge commands to maneuver through the file; the current line is always the one being edited. All Filge commands begin with a slash (/), and end with either the Enter key or the Escape key. (Refer to your communication software instructions for the placement and use of the Escape key.) Any text entered that doesn't begin with a slash is considered part of the file's data. Maximum line length is 140 characters.

When you first enter Filge your file area will be empty. Type your message: if you make a mistake on the line you're typing, use the backspace key and retype your correction. When you get to the end of your display line (remember the maximum line length), press Enter for the next line (limiting the line length to one display line makes it easier to correct things later).

If you notice an error in one of the previous lines, there are several ways to move from the current line to the line with the error. The easiest way is to type /Nn, where n is how many lines to move. If n is negative, you'll move back (up) that many lines. Typing /N without any n moves you to the next line.

The Next line command doesn't display the new current line unless you spe-

cifically tell it to do so by terminating it with the Escape key: thus, typing /N-1\$ (the dollar sign is used by Filge to acknowledge that you typed the Escape key) will move you back one line and display that line.

Once you've changed this current line pointer to the correct line, make your corrections. Since Filge is a line-oriented text editor, you can't just go to the error

*"Composing and sending
a message is more
difficult. You need
the recipient's PPN..."*

and type over it: you have to replace it with the corrected text.

To do this use the Change command: /C/oldstring/newstring. This command has several options. If you want to delete the old string, type /C/oldstring. To insert a new string at the beginning of the current line, type /C//newstring. If the alteration in the current line is the same as the last change, just type /C. And if you have sev-

eral old strings in the current line and need to change only one of them, use /Cn/oldstring, where n is the number of the occurrence of the old string which you want changed.

To replace a slash, use the comma as a delimiter. If you have to change the same old string in many different lines to a new string, use the Global change command: /GC/oldstring/newstring. /GC/oldstring will search for "oldstring" and erase it each time it's found. If you need to replace only the nth occurrence of the old string, the format is: GCn/oldstring/newstring.

Like the Next Line command, to have the line displayed terminate the Filge command with the Escape key instead of the Enter key.

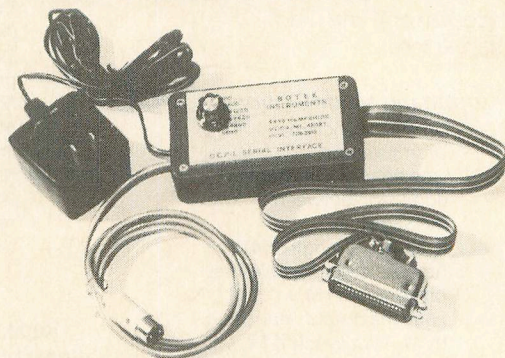
If you know something is misspelled but don't know where it is in your file, go to the top of the file with the /T command, then use the locate command: /L/string. This moves the current line pointer to the first line following that contains the specified string. End the command line with the Escape key if you want the line displayed when the string is found.

Should you forget which line you're on, use the /P command to display the current line. If you want to see the next

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$n - 1$ lines, use /Pn (since one of the n lines is the current line). The current line pointer is moved to the last line displayed. If you want the current line deleted, type /D. To remove several lines, type /Dn, which deletes n lines, including the current line.

To replace the entire current line with new text, use the /Roldline/newline command. The current line pointer isn't changed.

Since you can use the /C//newstring command to add to the beginning of the current line, you need some way to add to the end of the current line: /A/string does this for you. If you don't specify a string, the last string used with the Append command is used again.

To jump to the last line of your file without using /N or /P, use the /B command: don't forget to terminate the command with the escape key if you want the last line displayed.

The final Filge command is /EX, which removes you from the Filge editor and takes you back to EMA-4. For a complete list of the Filge commands, see the Filge Commands list.

Advanced User Options (OP)

Menu

- 1 — Change top command mode.
- 2(LL) — Change line length.
- 3(T) — Return to function menu.
- 4(P) — Make options permanent.

Multiple user option commands can be placed on one line; i.e.:

OP;LL80;T;RF1000.

User Command Mode Options

- T — return to function prompt/menu
- ST — stop between messages (*)
- NS — don't stop between messages
- LL — change line length (64)
- NL — number of displayable lines on terminal (16)
- PG — page the output, length set by NL. Works only if ST is enabled
- NPG — no paging (*)
- RNS — makes RN command skip messages you left
- RNT — makes RN command list messages you left
- BR — brief mode, stops repetitious displays of options
- NB — turns off Brief (BR) mode (*)
- PC — change prompt character
- TWM — type waiting messages
- MWM — mark waiting messages (*)
- CN — change your SIG name
- DS — set default log-in message section (0)
- RNT — RN command types all messages (*)
- P — makes changes permanent

MEN — turn off command mode, use menus

Options chosen are indicated by asterisks, those with numerical values give the current value. Normal default settings are shown above. Not all commands are available; some Sysops have disabled the CN command.

Filge Editing Commands

- /A — append
 - /A/new — add newstring to end of current line
- /B — bottom, go to bottom of file
- /C — change, current line only
 - /C/old/new — replace oldstring with newstring
 - /C/old — delete oldstring
 - /C//new — add to beginning of current line
 - /C — make same change to current line as last time
 - /Cn/old/new — change n th occurrence of oldstring
- /D — delete: remove current line
 - /Dn — remove n lines
- /EX — exit Filge
- /GC — global change, entire file
 - /GC/old/new — replace oldstring with newstring throughout file
 - /GC/old — delete oldstring throughout file
 - /GCn/old/new — replace n th occurrence of oldstring with newstring
- /L — locate
 - /L/string — search file from current line to end of file for string
- /N — next line, move current line pointer
 - /N — move down one line
 - /Nn — move down n lines
 - /N-n — move up n lines
- /P — print, display lines
 - /P — display current line
 - /Pn — display n lines, put current line pointer to last line displayed
- /R — replace
 - /R/old/new — replace old line with new line
- /T — top, move pointer to top of file

Repeat commands by placing the repeat count n in front of the command.

Terminate commands with the Escape key to make current line display after command is executed.

Put multiple commands on one line by separating them with commas; use apostrophes as delimiters instead of slashes; i.e., /T,L'ABC',C'A'XXX'\$ will go to top of file, search for the line with ABC, change the A to XXX, and display the current line. If you want to display lines via the Escape key, use the semi-colon instead of a comma.

Multiple commands on a line can be repeated by putting them in parentheses, preceded by the multiplying factor.

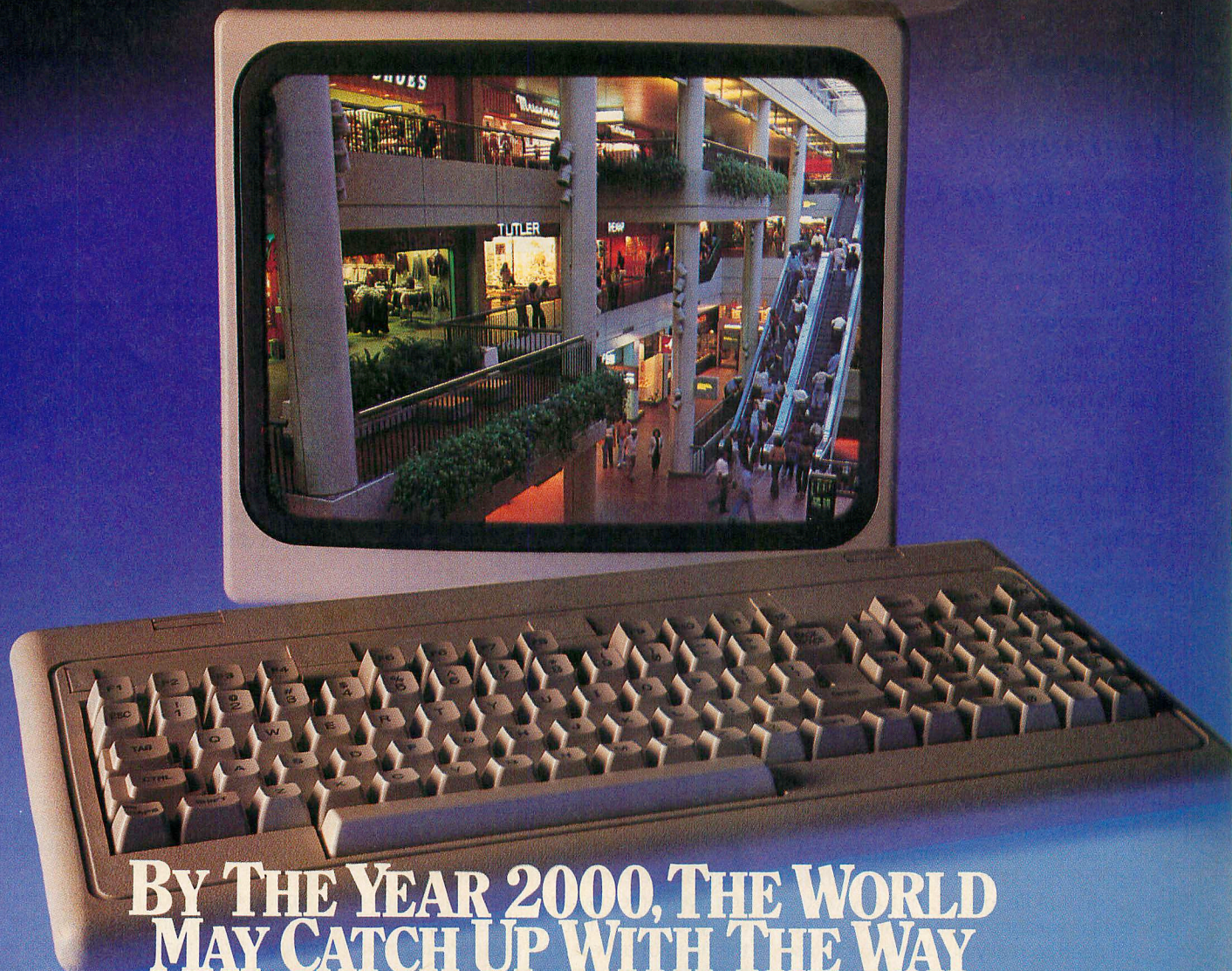
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Learning To Program in C

by Thomas Plum
Prentice-Hall, Inc.
200 Old Tappan Road
Old Tappan, NJ 07675
(201)592-2000

300 pages
\$25 paperback
\$32.95 hardcover

IF, AS A PROGRAMMER, you want to go beyond Basic but not all the way to assembly language, you'll find C a comfortable compromise. It lets you generate object code, which in turn generates assembly language, so you can do anything you'd want to do with assembly language without having to spend all your time dealing with assembly language details.

Learning to Program in C is an arm-chair tutorial that assumes you know about programming and programming theory. It's very thorough, and much of it is beyond the average user. Yet it offers a lot to *any* programmer by sticking to just a few examples throughout and taking things one step at a time. The book discusses full-fledged C, not any of the particular versions on the market. What you'll need to really put the book to use is a familiarity with the commands your compiler will and will not accept.

Plum begins by telling you how C developed and what makes it unique. Chapters on data, operators, statements and control flow, functions, software development, and pointers and structures follow. Those subjects are so well covered that the book is a great reference work as well as a tutorial. Appendices include a C language reference and a summary of chapters in table form. Helpful hints, the kind you usually have to learn on your own, are scattered throughout, and standard conventions are identified and discussed.

I read the book through before trying to use the language. That gave me a good feel for structure and syntax. Then I re-read the book, using the examples as exercises after modifying them to run on the Color Computer. Almost as much space is devoted to examples as to text. Most Color Computer implementations of C contain all the important C commands; usually it's only the bells and whistles that are missing.

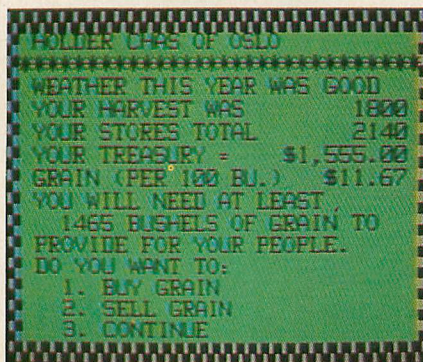
I highly recommend this book to anyone wishing to put C to work. C is a

pleasant programming environment, and reading this patient book is an informative, enlightening experience.

— Norman Garrett

Viking

Prickly Pear Software
9234 East 30th Street
Tucson, AZ 85710
(602)886-1505
16K cassette
\$19.95



IT IS 750 A.D. and you are ruling a small mercantile Viking settlement. If you overcome plagues, revolts, and raiders, you will find yourself years later as the head of a large and prosperous city. If you don't, you can lose it all.

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My 15-year-old son approaches Viking like a wolf to a trapped deer herd. He will starve the people, raise taxes to the hilt, and do anything else he must to increase the treasury. He has won using this strategy. I, an enlightened, compassionate 20th century man, try to keep the common folk happy. I have also won. What this suggests to me is that Viking reflects political and economic reality, and that's no small compliment for a simulation.

Public administration majors will find Viking a refreshing break from their dry,

pragmatic texts. Anyone else with a yen to manage a public will enjoy it, too. Just CLOADM and the program automatically executes for you. It accommodates up to four players and has nine levels of difficulty.

— Thomas Taulli

Option 4

YGS
Box 308
Brechin, Ontario
Canada L0K 1B0
(705)484-5691
32K, printer
\$149.95 disk

OPTION 4 IS A CANADIAN payroll program with automatic Social Insurance Number validation, formatted screens, error trapping, and disk, printer, and archival tape transfers. It provides detailed pay stubs and batched checks, total cost/duty allocations, gross pay reviewing for any period, and a yearly user update. It is one of seven integrated business programs that do everything from cash-watching to job and material costing.

Option 4 is for you if: you do the book-keeping for a Canadian company that employs more than two or three workers; your workers are paid by the hour and on a weekly basis; no separate record of sick leave is required; you have an Epson MX80 printer or one with similar control codes; you have or want pre-printed checks; and you are capable of some simple Basic programming. It's a long list of ifs, but Option 4 is a specialized product.

This program provides constant prompts so there is no chance of unknowingly losing data. Its tape archive system lets you back up your data to cassette. There are screen dumps and print-out options for key information, and there are paycheck and comprehensive stub printing features. There are, however, weaknesses in the program.

The line that lets you sort or view files by check number has a glitch. Line 490 has been deleted without the GOSUB in Line 1050 having been changed. That would be easy enough to do, but the program has been protected. If you have the program and already know how to get into it, changing the GOSUB 490 to GOSUB 510 seems to solve the problem. But the security feature brings up another problem. If you hit the Break key by acci-

An Important Bulletin for Home Computer Users

*This is the only programming system you'll ever need
for your home computer.*

If you own a small home computer, the story we're about to tell you could be of great help. It's about a revolutionary new software programming system that will let you and your entire family take full advantage of that machine you bought. But first things first, so here's a list of the home computers this product was specifically designed for: Atari 400, 600, 800, XL Series; Commodore Pet, VIC 20 and 64; IBM PCjr; TRS-80 color computer; TI-99/4A and the Timex Sinclair 1000, 2048 and 2068. If you own one of these computers, it would be well worth your time to read further.

THE PROBLEM WITH HOME COMPUTERS

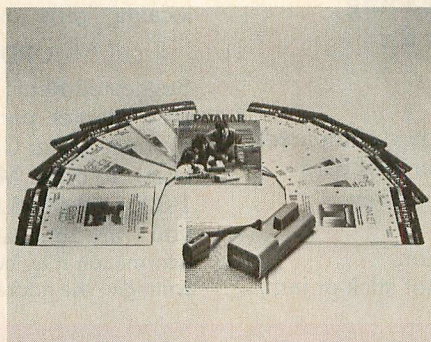
As you probably know, the problem with these small computers is how to get good software into them. Keyboard entry is too time consuming. Diskettes do the job well, but the loaders are expensive and so are the diskettes. Cassette loading is less expensive, but the cassettes themselves still aren't cheap and sometimes a program has to be read again and again before it actually is entered. Furthermore, few of these software manufacturers guarantee their product to run at all.

So unfortunately, a lot of these potentially useful computers are relegated to just game-playing or, even worse, they find their way onto a closet shelf somewhere behind the bowling ball or last year's magazines.

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THE DATABAR CLUB

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family oriented magazine also features articles on related subjects and computer use in general. The subjects covered by the software include: games, home management, classroom learning, health, law, science, writing skills, and computer programming. What's more, Databar Club members get a three-ring binder for their software programs as well as eligibility for exciting contests.

But whether you join the Databar Club or purchase individual program packages from your favorite retailer — OSCAR can dramatically change the amount and quality of the use you get out of your computer. And let's face it: in the not so distant future much of an individual's competence will be tied up in how well he or she interfaces with a computer.

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dent while going about your legitimate business everything you've done up to that point will be lost unless previously saved to disk or tape. Granted, users are amply warned to always save data, but it would have been better to inactivate the Break key.

One other fault is the inability of the program to keep track of sick leave. It does allow the accumulation of extra hours and, in a short week, hours are automatically drawn from this accumulation. This lets sick time be made up from overtime but there is no record of the transaction.

Provincial governments are constantly changing the rules of the paycheck game. If you don't know how to change the provincial calculation formulas you will find yourself again doing the payroll by hand. YGS will do annual upgrades for 30 percent of the program's current retail price, but depending on an outside source may leave you doing the payroll by hand for a long time if the provincial government decided to change the formula in the middle of the year. The manual tells you only how to call up formulas for changing: *you* must know how to make the changes if you want to save time.

Now for the trivial faults:

Some screen routines seem unnecessarily slow. You have to just sit and watch them.

Once you begin inputting data into a routine, there is no escape; you have to finish all the entries.

If you make a mistake in one field, you have to re-do all fields to correct it. If you are not a good typist, you may find this particularly annoying.

"To correct mistakes you have to re-do all fields. You may find this particularly annoying."

There are two data formats used, one right after the other. In one case you enter a date with slashes between the month, day, and year, and the month is entered as two letters. In the second case you enter the date as one continuous number.

Error messages flash at high speed in lowercase video. They are hard to read

and only stay on briefly. Once you realize what the message is, the prompt makes you wait. A steady prompt that would require pressing the Enter key to clear would be better. In one case a line of a screen scrolled off the top before I could read it. In another case a whole screen was sometimes whisked away before I could see what it was about. The latter problem was intermittent, though.

The program is set up primarily for salaried employees or employees working on an hourly basis and paid weekly. It is much harder to use if you pay your employees less than once a week.

The price is high. Whether this is a trivial fault or not depends on your budget, but \$150 is about as high as Color Computer programs go and this one has not been streamlined and debugged to the point that it should demand top price.

The manual is well-organized and easy to follow, except the index is on page 14 rather than the last page.

YGS will replace an unloadable disk free of charge within 90 days of purchase, and will replace an unloadable or damaged disk within the year of purchase for 10 percent of the current retail price. Getting a new manual or having your password changed costs 15 percent of the current retail price.

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YGS will also modify the program for your printer at its current hourly rate but again that is something you can do yourself — the manual tells you how to get into the printer-driver program.

Other programs in the YGS line include checks payable, cash journal, mailing, general ledger, pay journal and a time and material costing program. All but the checks payable program cost \$49.95. Checks payable is \$69.95.

—R. Bartley Betts

them. Infotools wrote the program for only one line between questions. Line 2290 in the early version omitted a carriage return message. The fix is to GOTO 2290 and type ,CHR\$(13); just after PRINT\$ -2.

While editing you can scroll with the left and right arrows. A to-be-replaced prompt has you type in what you want changed, then what you want it changed to.

The "display and select question" mode has a nice feature, Test Queue. You pick which questions you want to print with the Shift and Up Arrow keys, which also assigns numerical positions to

these questions. Only questions listed on the queue will be printed.

The Print Out command lets you begin printing at any question number, so you can partially print one file, then load another and keep printing in sequence.

The Renumber command lets you raise or lower a test number by entering how many numbers you want to move it (+4 or -7). Count and Clear shows you how many items are in a file and lets you clear file memory.

The Heading command, of course, lets you write heads. It has no centering ability, though. But with a little time to figure out the necessary spacing you can write

Test Aid

Infotools
111 Country Club Lane
Oxford, OH 45056
(513)523-8473
32K, 64K
\$18 cassette

T IRED OF SCHLEPPING through the chore of writing tests, teachers? Dissatisfied with the questions on ready-made tests? Then Test Aid could be for you.

Test Aid lets you write, save, edit, format, and print questions. It also prints questions in any order you want, from one or more files. You can write up to 50 questions consisting of over 700 characters per question. The program has automatic word wrap and page breaks, and comes with a concise 15-page instruction booklet, too.

The loading directions have you enter PCLEAR 1 and CLOAD, but don't tell you to remove your disk drive. I tested the cassette version only, which won't operate with a disk in place. An enhanced disk version was due out as this review was being written.

Another minor kink regards typing commands. On the screens commands are in lowercase first letters followed by all uppercase letters. You have to type commands in uppercase only, though.

Test Aid's commands are: Generate New Questions, Print, Edit, Display and Select Questions, Save to Tape, Load from Tape, Renumber Question, Count and Clear, and Heading. When you want to write new questions the screen shows a > about halfway down to let you know how far you can type before you run out of room. The screen doesn't word wrap but the printer does.

After generating a question the screen switches to a formatted screen with four answer spaces. Because no links are skipped between questions, there's no space for answers on tests that require

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Color Computer News, June '83

Mark Data Products is well known to us "longtimers"... Every bit as finished as if Tandy had done it... The Mark Data Super-Pro is your best buy... The one that is in my CoCo to stay...

Color Computer Magazine, June '83

The installation procedure is well detailed and quite simple... Has a professional feel, reacts well to the touch... has held up to some purposeful pounding...

Hot CoCo, August '83

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Rainbow, April '83

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directions before a heading.

Test Aid's drawbacks are minor. I feel the program is the result of a serious attempt to take the tedium out of writing tests. If you don't mind doing a little digging beforehand, it will suit your needs nicely.

—Michael Garozzo

Color Demon Seed

Computer Shack
1691 Easton
Pontiac, MI 48054
(313)673-8700

32K

\$27.95 cassette

\$29.95 disk

COLOR DEMON SEED is a challenging, even devious, arcade game. It offers as much firing action as anyone could want, swarms of attacking bats and demons, and an attack ship that tries to crush you.

You start off with five ships and lose one each time you get shot or killed. I found no way to replenish the supply of ships. Your ship is at the bottom of the screen and moves only left and right,

therefore you shoot only upward. The number of ships left and your score are given at the top of the screen.

You fight two waves of bats, then two waves of demons, then the attack ship. That cycle repeats itself. After the second, fourth, and sixth rounds are special challenge stages.

Each wave of bats is over a dozen strong. The bats flit back and forth, then swoop down on the attack. Each bat attacks for about 20 seconds, then flies back to the top of the screen for awhile before attacking again. As many as eight or 10 may attack at once, flying in all directions and crossing each others' paths. Their dirtiest trick is to fly off screen and swoop in low from the side a few seconds later. They can kill by either shooting or crashing into you like little leathery Kamikazees. They can fire one shot or up to half a dozen in rapid succession. Every bat in each wave must die if you are to get to the next.

The demons appear as seeds flying back and forth, seeds that hatch into monstrous, wide-winged, vulture-like creatures. They attack more viciously than the bats, sometimes with several seconds of automatic fire. They also kill at a touch. With both types of waves you get two shots on the screen in the first at-

tack but only one in the second.

If you survive long enough, you face the attack ship, huge and relentlessly sinking toward you. It will crush you if you don't shoot through its underside, which is protected by a rotating shield. Killing the gargoyle pilot inside is most difficult; debris is falling and self-sacrificing bats are diving from both sides. Speed and accuracy with your weapon are crucial if you are to succeed. Sound challenging? You bet, but despite the odds all is not working against you.

You have a shield that, if used wisely, can be a very effective offensive weapon. You can shoot while shielded, and your attackers perish if they collide with the shield. If it's raised just before a multiple attack it can wipe out half a dozen bats at once. The danger in using it too much though, is that you don't control when it's removed, and sometimes you turn vulnerable at just the wrong time.

This game can be played with a joystick or from the keyboard. I found the joystick better because it's hard to simultaneously control ship movement, shooting, and the shield from the keyboard. A pause feature lets you take a break or study the graphics, which are well-done but not outstanding. The game keeps a running list of the 10 highest scores dur-

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PAYROLL (Version 2.0) This integratable package is designed for maintaining personnel and payroll data for up to 200 hourly and salaried employees with 8 deductions each. This system calculates payroll and tax amounts, prints checks and maintains year-to-date totals. These amounts can be automatically transferred to the SBA package for financial reporting. It computes each pay period's totals for straight time, overtime, and bonus pay and determines taxes to be withheld. Additional outputs include mailing list, listing of employees, year-to-date federal and/or state tax listing, and a listing of current misc. deductions. This system is suited for use in all states except Oklahoma and Delaware. \$69.95

All programs require a minimum of 32K and 1 disk drive but will take advantage of 64K and multiple drives. Each package features a hi-res 51 x 24 black on green screen. 16K versions available without hi-res screen. Specify 16K or 32K versions when ordering. Future integrated packages will include: Inventory Control, Sales Analysis, Accounts Payable.

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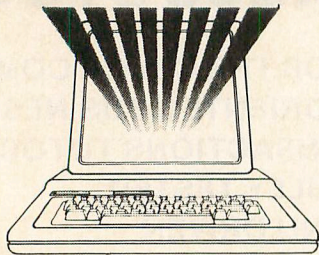
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Super Screen is a powerful, machine language program that significantly upgrades the performance and usefulness of 16K or greater, Extended and Disc Basic Color Computers. The standard Color Computer display screen is totally inadequate for serious, personal or business applications so Super Screen replaces it with a brand new, 51 character wide by 24 line screen including full upper and lower case characters. Instead of a confusing checkerboard appearance, you now have true lower case letters along with a screen that is capable of displaying 1224 characters. The difference is startling! Your computer takes on new dimensions and can easily handle lines of text that were simply too long and complex to display on the old screen.

COMBINE TEXT WITH HI-RES GRAPHICS

You can now write truly professional looking programs that combine text with hi-res graphics. Super Screen allows you to create graphics displays with the Basic LINE, DRAW and CIRCLE statements and then notate the graphics with descriptive text. You can even use PRINT @ if you wish for greater programming convenience. Super Screen's versatility will amaze you.

PRINT @ IS FULLY IMPLEMENTED

The PRINT @ statement is a valuable asset to the programmer when formatting text on the screen. The standard Color Computer will report an error if you specify a location higher than 511 but Super Screen allows locations all the way to 1223! You get a big screen and a powerful formatting tool as well. Of course, Super Screen also supports the CLS command allowing you to clear the big screen using standard Basic syntax.

ON ERROR GOTO

That's right! Super Screen gives you a full implementation of ON ERROR GOTO including the ERR and ERL functions. Now you can trap errors and take corrective action to prevent crashed programs and lost data using the same standard syntax as other computers. The ON ERROR GOTO capability overcomes a serious deficiency of Color Computer Basic and greatly improves your capability to handle sophisticated tasks. All well written, "user friendly" programs use error trapping techniques and yours can too! Now that's power!

AUTO KEY REPEAT

No more frustration as you edit a long line in your Basic program; just hold the space bar down and automatically step to the desired position in the line. Need a line of asterisks? Hold the key down and auto repeat will give them to you. Those of you who spend many hours at your keyboard will appreciate this outstanding addition to Super Screen's long list of impressive capabilities.

CONTROL CODES FOR ADDITIONAL FUNCTIONS

Super Screen recognizes several special control code characters that allow selection of block or underline, solid or blinking cursor and other functions. You can "Home Up" the cursor or you may erase from the cursor to the end of a line or to the end of the screen just like many other computers. These special codes give you an extra dimension of versatility and convenience that put Super Screen in a class by itself.

AND MORE GOOD NEWS...

Super Screen comes with complete, well detailed instructions and is available on cassette or disc. It adjusts automatically to any 16K or greater, Extended or Disc Basic Color Computer or TDP-100 and uses only 2K of memory in addition to the screen memory reserved during power up. Guaranteed to be the most frequently used program in your software library...once you use it, you won't be without it! Super Screen's low price will really please you; only \$29.95 on cassette or \$32.95 on disc!

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Mark Data Products SUPER BUG is a powerful, relocatable machine code monitor program for your Cocom. If you are a beginner, the program and documentation are an indispensable training aid, helping you to gain a better understanding of your Color Computer and machine code programming. If you are an accomplished computerist, SUPER BUG's capabilities, versatility and convenience will prove invaluable during programming and debugging.

SUPER BUG offers so many outstanding features that we are unable to list them all in this limited space. hex and alpha numeric memory display, modify, search and test; full printer support with baud rate and line feed select; up to 220 breakpoints; mini object code disassembler; 64K mode setup; decimal, hex and ascii code conversion routines and extensive documentation. Only \$29.95 on cassette or \$32.95 on disc.

ORDER ENTRY SYSTEM

The Mark Data Products sales order processing system will give a fast, efficient means to enter orders, print shipping papers and invoices, prepare sales reports, and monitor receivables. The system automatically enhances the monitor screen to a 51 character by 24 line display. 32K of memory is required along with an 80-column printer, and one or more disc drives.

The MDP order entry system is a family of programs which operate interactively by means of a "menu" selection scheme. Up to 900 products may be defined and a single disc system can hold over 600 transactions. When the operator selects a task to be performed, the computer loads a program designed to handle that task from the system disc. The system disc contains all of the programs required to create, update and maintain data files and prepare the necessary paperwork including shipping and invoice forms, daily sales reports, a monthly (or other period) sales report and a receivables report.

The MDP system:

- Is accurate, user friendly and simple to use.
- Is easy to customize for specific user requirements.
- Produces a traceable invoice.
- Handles receivables as well as closed orders.
- Is capable of future expandability.

This accounting software equals or exceeds higher priced packages for other computers and includes a detailed operating manual. For just \$99.95.

ACCOUNTING SYSTEM

The Mark Data Products accounting system is ideal for the small businessman needing a fast, efficient means to process income and expenses, prepare detailed reports and maintain most of the information required at tax time. The system is a family of programs which operate by means of a "menu" selection scheme. When the operator selects a task to perform, the computer loads a program designed to handle that task from the system disc. The system disc contains all of the programs required to create, update and maintain data files and prepare the necessary accounting reports including a transaction journal, a P&L or income report, an interim or trial balance and a balance sheet.

Up to 255 separate accounts may be defined and a single disc system can hold over 1,400 transactions. This system automatically enhances the monitor screen to a 51 character by 24 line display. 32K of memory is required along with an 80-column printer and one or more disc drives.

The MDP system:

- Is accurate, user friendly and simple to use.
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ing any one playing session.

Color Demon Seed is written in assembly language with artifactual PMODE 4 color mode (blue, red, and buff on a white background). Its bizarre sounds add to the effect of being attacked by extraterrestrials. The game sounds markedly when demons fire multiple shots, but that gives neither side any advantage. This game will put your hand-eye coordination to the acid test.

—Raymond Mosteller

The Color Connection

Computerware
Box 668
Encinitas, CA 92024
(619)436-3512
16K
\$29.95 cassette
\$39.95 disk

THE COLOR CONNECTION, a terminal program, lets you access on-line databases, bulletin boards, and electronic mail.

There are two versions on both tape and disk. One works with the standard 32-character, 16-line configuration. The other generates true upper- and lower-case on 51-character lines and 24 lines per screen and leaves 18,158 bytes free in a 32K computer.

With the Color Connection, you can change and load set-up files, go to terminal mode, and use the free spare in your computer as a buffer.

A set-up file lets you determine and save communications protocol. You can set word length (seven or eight bits), line feeds, parity, duplex, word wrap, inverse or normal screen, upload and download parameters, and, if you have an autodial modem, phone numbers.

The program also lets you configure up to four macros, or programmed function keys. You might want to define log-on or log-off command sequences as macros. One thing you can't change is baud. The Color Connection operates at 300 baud only.

After you've set up a file you move into the terminal mode. In this mode, key sequences let you open and close the buffer, erase its contents, use autodial, transmit macros, and transmit the contents of your buffer. These commands let you upload or download files or simply

communicate with another computer.

You can also view the buffer, send it to tape or disk, load files to it, and input to it from the keyboard. Sending the buffer to tape or disk lets you download and store files. Entering terminal mode lets you put a file in the buffer for uploading.

I tested the cassette version only of this program. It worked in a straightforward manner and without flaws. Saving to tape was easy and reliable. The 14-page instruction booklet is clear, concise, and contains all the information you'll need.

—Norman Garrett

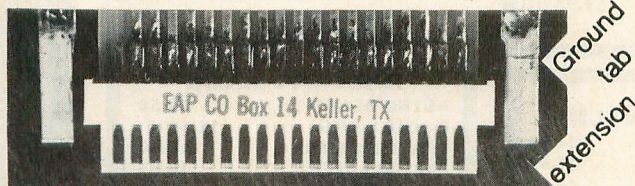
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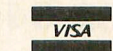


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Decision Maker is an aid to sorting out pros and cons. First you make a list of choices, then a list of criteria to consider when evaluating those choices. Each criterion can be given a numeric ranking to indicate its importance.

If I were facing a decision about buying a new car, I might narrow my choices down to a Chevy, a Ford and a Dodge. I have to decide what criteria will influence my choice. Comfort, economy, reliability and cost are my main concerns, so I rank each car accordingly. The program then takes the points assigned and comes up with a "best choice." It is a tool for seeing facts differently than you might otherwise look at them. It will *not* say what is right or wrong.

You can enter 10 choices with up to 39 points for or against each option. With that capacity you should be able to describe most situations.

The package I received consists of a five minute tape and a 16-page instruction booklet. A sample problem shows the computer's display and some responses, program operations, format of expected responses, and program limitations. Decision Maker can be saved to disk.

The documentation doesn't say how to load the program, but a simple CLOAD

will do. You don't need to PCLEAR anything. The documentation says Decision Maker is for 32K, but you can use it in 16K (no disk here) by typing POKE 25,6:NEW before CLOADing. The total memory used is just over 13K.

There are errors in the documentation. The first prompt requests a description of the decision to be made in 31 characters or less. Actually only 30 characters are

*"The next bug
is to your advantage;
I was able to enter
40 points after modification."*

accepted. Enter the thirty-first and you'll be told the line is too long. You will then have to retype the entire line.

The next "bug" is to your advantage. The documentation says you are limited to 39 points for and against. I was able to enter 40, after modifying the program. As written, the program doesn't clear sufficient string space to enter more

than eight points for and against. The cure is easy. Edit Line 90 and change the CLEAR 500 to CLEAR 1500.

The best way to master the program is to read through the instructions, load it and type in the sample problem. After using Decision Maker once or twice you should be able to file the instructions away and forget about them.

The program is well written and seems idiot proof. All entries are checked for type and limits. If you enter a number outside the stated range a tone sounds and you are told what you did wrong. Decision Maker also chides you if you try to enter anything other than numbers when numbers are expected.

The program permits editing on the current line using the arrow keys. Once a line is entered, editing is restricted to an edit screen at the end of each segment of the program. Just enter the number of the line you need to modify. The cursor moves to that line and you retype it. Typing a space then hitting the Enter key deletes the item. Once you indicate that you are finished with a particular segment, you can't go back. Make sure you make all corrections as you go. Unfortunately, you have to keep track, with pencil and paper, of the entries on each screen. Those entries are limited to 11

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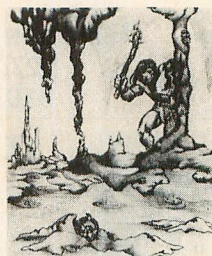
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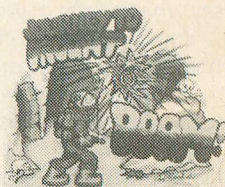
We've done it again! You thought the King was great? wait 'till you see this!! Outstanding high resolution graphics, tremendous sound make this "Joust" type game a must for your software collection. As you fly from cloud to cloud you will enjoy sky high excitement dealing with the challenges presented to you by this newest release by Tom Mix Software.



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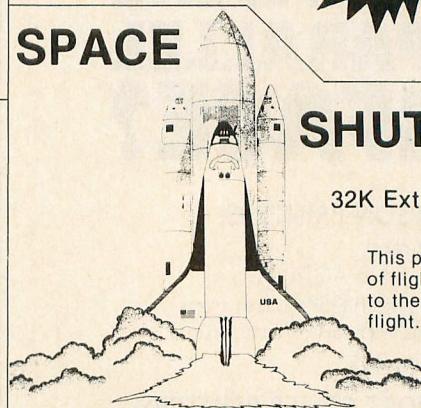
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"TRAPFALL"

By KEN KALISH

ARCADE ACTION

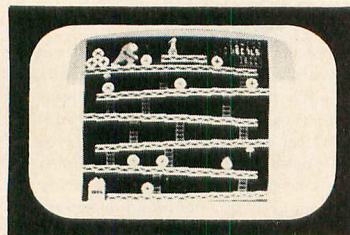
The "Pitfalls" in this game are many. Hidden treasures, jump over the pits, swing on the vine, watch out for alligators, beware of the scorpion. Another game for the Color Computer with the same high resolution graphics as "The King."



16K MACHINE LANGUAGE
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THE KING

32K Machine Language
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per screen, and you can not return to previous screens.

The program concludes by displaying what choice received the most points, and then displays the options in the order you listed them. This screen should list choices by point value instead! The ability to re-enter the program and make changes after seeing the final screen would make the program both easier to use, and used more often.

"No one has yet written software capable of making decisions; but it's fun."

This is a pretty good program. Despite its name, however, no one has yet written Color Computer software capable of actually making decisions, and Armadillo knows it. But it's fun. Now, about that week off... should we go helicopter skiing in Alaska, diving in the Caribbean, or weed the lawn?

— Gary W. Clemens

Color Tutor

Elite Software
Box 11224
Pittsburgh, PA 15238
(412)795-8492
16K
\$19.95 cassette
\$22.95 disk

COLOR TUTOR is an electronic pedagogue, a tutoring program that accepts up to 50 brief questions and answers. Each entry can be 32 characters long on a 32K machine or 64 characters long on a 64K machine. The program asks questions at random and keeps track of whether answers are right or wrong.

One noteworthy feature is its optional correct spelling mode. If you want, the program will insist on correct spelling; just type YES. Typing NO sets the tutor up to indicate that a correct answer's been given even if spelling is wrong; the only hitch is that the first three letters of the answer have to be spelled right. This feature is handy when you're more concerned with correct answers than proper spellings.

Unlike its ancient Greek predecessors,

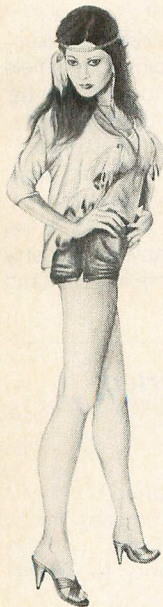
one thing this pedagogue can't do is keep its students on the straight and narrow. But it knows they're liable to succumb to a sneaky streak on occasion. For instance, they might try and read the questions on the sly, or even write their own answers into the program. So it has a password. No one can get into the edit mode without the password. And if the password is discovered, it can always be changed.

The program automatically assigns numbers and question marks. Editing is a simple matter of retyping entire questions or answers. The program saves questions until you exit, when they are erased. Instructions are straightforward and come on a single, heavy-duty piece of paper strong enough for your file cabinet.

I think the program is a good, dependable one. But there are two things I don't like. I prefer two chances to answer a question before being given the correct answer. Color Tutor allows only one. And if you type in a wrong answer the screen says NO!!! IT IS: whatever the answer is. That, for my taste, is too blunt. I feel like the computer is yelling at me. I'd prefer a NICE TRY BUT THE ANSWER IS message, or something along that line.

— Michael F. Garozzo

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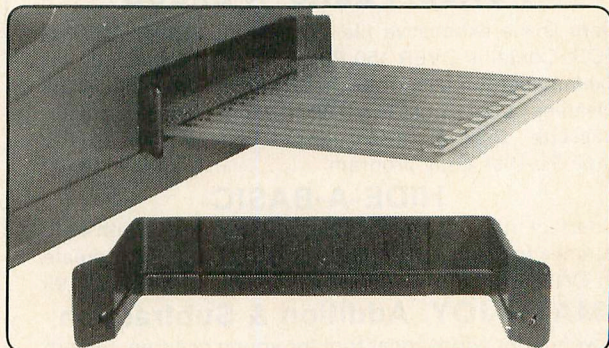
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Microindex

Serious Personal Computing
Box 7059
South Nashua, NH 03060
(603)888-1376

The Microindex is a reference source for editorial coverage of microcomputers, listed by type of computer and by applications. United States prices are: \$99 a year or \$12 an issue for the monthly version; \$49 a year or \$6 an issue for the abridged monthly version; and anywhere from \$5 to \$12 an issue for annual, "end-of-volume" versions. Serious Personal Computing also plans application- and micro-specific versions. The Color Computer version, Volume 1, was to be available in March 1984 for \$5.

OS/9 Programs

Computerware
4403 Manchester Ave.
Suite 102
Encinitas, CA 92024
(619)436-3512

Computerware has a couple of new products for OS/9 fans. The Advanced Editor loads O-Pak files, has 41 commands, 21 line editing commands, and doesn't ask you to count lines and characters to move the pointer. You can edit files larger

than memory because your disk can become a part of memory. You'll need OS/9, of course, and \$39.95 for this disk. Disk Fix and other OS/9 utilities cost \$29.95 and give users the ability to modify drive descriptors, copy disks and subdirectories, overwrite files, sort directories alphanumerically while copying, and more. Its "Patch" program inspects and modifies any disk file, and "FileLook" displays file modules without loading them into memory. "Compare" compares files with memory.

Elite-File

Elite Software
Box 11224
Pittsburgh, PA 15238
(412)793-8492

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Getting Started With CP/M

by Rob Patten
and Paul Calandrino
Hayden Book Company, Inc.
10 Mulholland Drive
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(201)393-6306

Getting Started With CP/M is for the novice CP/M user. It offers an overview of CP/M's structure and function, an introduction to and summary of commands, a command reference card, and a glossary of microcomputing.

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3. Printer
4. Modem
5. RAM chips
6. Keyboard
7. Interface Board

6 Where do you buy software?

8. Mail order
9. Radio Shack computer center
10. Radio Shack store (not computer center)
11. Other computer stores

7 How many software packages do you plan to buy in the next 12 months?

12. 1-2
13. 3-5
14. 6 or more

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4 How do you use your COLOR COMPUTER?
w. education
x. entertainment
y. personal purposes
z. business purposes

5 Which of the following peripherals do you plan to buy in the next 12 months?

1. Monitor
2. Disk drive
3. Printer
4. Modem
5. RAM chips
6. Keyboard
7. Interface Board

6 Where do you buy software?

8. Mail order
9. Radio Shack computer center
10. Radio Shack store (not computer center)
11. Other computer stores

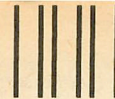
7 How many software packages do you plan to buy in the next 12 months?

12. 1-2
13. 3-5
14. 6 or more

Circle Number

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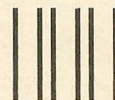
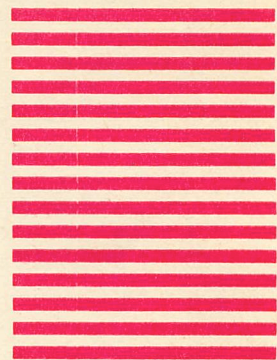
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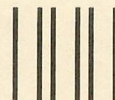
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Moonlighting With Your Personal Computer

by Robert J. Waxman
Ballentine Books
400 Hahn Road
Westminster, MD 21157

Whether you plan to moonlight as a programmer, writer, consultant, or service specialist, *Moonlighting With Your Personal Computer* has a chapter for you. This \$7.95 paperback also has chapters on how to get started, some pitfalls to be wary of, and alternative ways to establish a business.

Fastape

Spectrosystems
11111 N. Kendall Drive
Suite A108
Miami, FL 33176

This \$21.95 utility lets cassette operations execute at 3000 baud. Control key functions change speeds, and there is automatic adjustment of cassette and printer parameters.

DynaCalc for CoCo DOS

Computer Systems Center
13461 Olive Boulevard
Chesterfield, MO 63107
(314)576-5020

Now you don't need Flex to run DynaCalc. DynaCalc for Color Computer DOS runs on any 64K Color Computer with a disk drive. It features a 51-character by 24-column screen, auto repeat keyboard, printer drivers, two-dimensional video, and printed graphics. It costs \$150.

Computers, Education, and Special Needs

by E. Paul Goldenberg, et al
Addison Wesley Publishing
Reading, MA 01867
(617)944-3700

This 288-page, \$13.95 paperback is billed as a practical introduction to the use of computers by and for special needs groups — the handicapped, the disabled, and the excep-

tional. The book addresses the question: What are special needs, who has them, and how can a computer help? Six authors have concentrated on that, and on how communication, access, and motivation are affected when a computer is used as a tool for special needs education.

String Things

Creative Technical Consultants
Box 652
Cedar Crest, NM 87008

Two releases from Creative offer instruction on strings and string variables. Musical Strings is a \$17.95, 16K tutorial tape designed to stimulate musical creativity and an understanding of string variable concepts. *The Guide to String Variables* is a \$3.95 booklet that discusses variables in general, and the specifics of string variables.

Ancestors

Autumn Color Software
4132 Lay Street
Des Moines, IA 50317

Ancestors is a disk-based genealogy program that handles up to 500 records. Records can be displayed on-screen or printed. A three-generation pedigree chart can be displayed and paged forward or backward. Records hold 22 fields, including (besides the expected) fields for occupation, military service, religion, and residence information. Ancestors costs \$39.95 and requires 32K.

Dr. Stan

Dee Pee Data, Inc.
Box 11349
Columbia, SC 29211
(803)254-9595

Winning the on-screen race between spelling students and Dr. Stan is the educational motivation in this program. It accepts words of from two to 18 characters long. When students spell a word correctly three times, they jump ahead, but every time they misspell, Dr. Stan jumps ahead three spaces. You'll need 16K. The program costs \$39.95 on tape, \$49.95 on disk.



NEW GOOD STUFF FOR EVERY COLOR COMPUTER!

MAGIGRAPH—Turn your Color Computer into a graphic design center with the ease of a keystroke! **MagiGraph** makes it simple to create highly detailed figures up to and including an entire high-resolution screen. Designed for those with some experience in Basic and Assembly Language programming, **MagiGraph** includes: A full set of logical and pixel manipulation functions; a design editor; nine animation buffers; versatile I/O routines. If you're looking for the finest graphic development utility available for your computer, THIS IS IT! Cassette \$34.95 (16K required); Disk \$39.95 (32K Extended Color BASIC required); Amdisk cartridge \$44.95.

CSPool: COLOR COMPUTER PRINT SPOOLER

—Stop Waiting Around for the Printer! **CSPool** allows you to use your printer and computer concurrently, takes only 26 bytes of Color Basic's memory, and gives you 32K of print buffer. It's like having two computers in one! By intercepting characters sent to the printer and storing them in the upper 32K of RAM, **CSPool** allows you to run other programs while your printer is doing its job. **CSPool** is FREE with the purchase of a 64K RAM UPGRADE KIT from The Micro Works, or it may be purchased separately on cassette or diskette for \$19.95. Requires 64K; not for FLEX or OS9.

64K MEMORY UPGRADE KIT: For Rev. levels E, ET, NC, TDP-100s, and Color Computer II. Eight prime 64K RAM chips, instructions, and **CSPool**: \$64.95.

MACRO-80C: DISK-BASED EDITOR, ASSEMBLER AND MONITOR

—A powerful 2-pass macro assembler with conditional assembly, local labels, include files and cross referenced symbol tables. Supports the complete Motorola 6809 and 6800 instruction sets in standard source format. Incorporating all the features of our Rompack-based assembler (SDS-80C), **MACRO-80C** contains many more useful instructions and pseudo-ops which aid the programmer and add power and flexibility. The screen-oriented editor is designed for efficient and easy editing of assembly language programs. **MACRO-80C** allows global changes and moving / copying blocks of text. You can edit lines of assembly source which exceed 32 characters. Also includes DCBUG, a machine language monitor which allows examining and altering of memory, setting break points, etc. **MACRO-80C**—along with sample programs—comes on one Radio Shack compatible disk. Extensive documentation. \$99.95

MICRO WORKS COLOR FORTH—This Rompack contains everything you need to run Forth on your Color Computer. **COLOR FORTH** consists of the standard Forth Interest Group (FIG) implementation plus most of FORTH-79. Includes super screen editor with split screen display, a decompiler and other aids for learning more about this fascinating language. Uses Hi-Res graphics, joysticks and sounds. Includes 112-page manual with a glossary of system-specific words, full standard FIG glossary and complete source listing. **MICRO WORKS COLOR FORTH...THE BEST! \$109.95**

SDS-80C—Our famous Rompack editor, assembler and monitor. Complete manual included with this comprehensive software development system. \$89.95

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—Allows you to get printouts while using your modem. Also download to cassette. General purpose terminal Rompack: \$59.95

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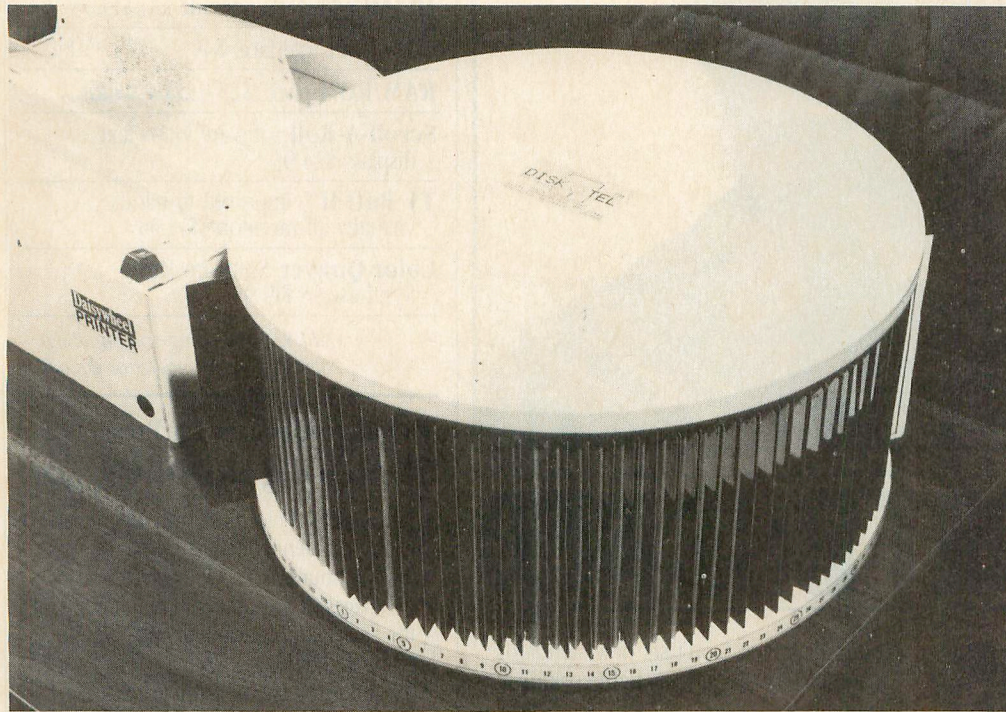
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Disk-O-Tel

Close Enterprises
Box 13903, Department 39
Arlington, TX 76013
(817)429-9006

Here's a lazy Susan-type disk storage unit for you. It's 14 inches wide, six inches tall, and mounted on ball-bearings. Your disks will be stored dust-free,

Close claims. An index is included. The desktop unit costs \$49.95. Another "high rise" unit mounted on a swivel arm and desktop clamp costs \$59.95.



Hi-Res Screen Print Utilities Program

Radio Shack
1800 One Tandy Center
Fort Worth, TX 76102
(817)390-3300

Users can print in four colors or in black and white with this \$9.95 cassette program. Dump programs of both types are included for print-outs of charts, graphs, logos, or what have you. You'll need at least 16K.

Micro Games

Radio Shack
1800 One Tandy Center
Fort Worth, TX 76102
(817)390-3300

MC-10ers and Micro Color users get five games on a \$9.95 tape. "Pong" is self-explanatory. "Breakout" is something like pinball. "Egg Catch" is over when the bird covers the ground with eggs. It's a flying egg-laying bird and users have to catch eggs in the air and

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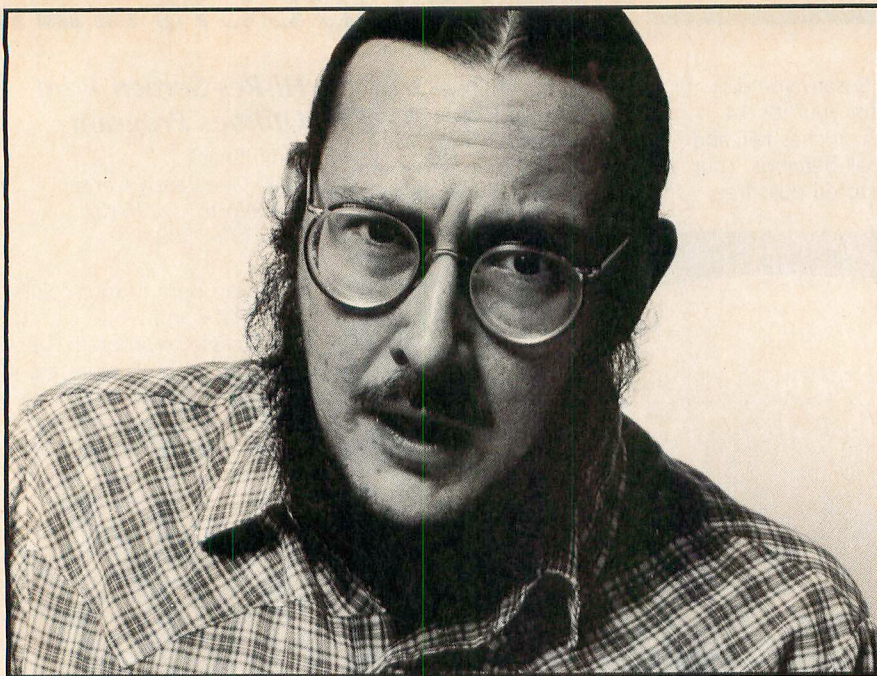
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THE COLOR BURNER FROM GREEN MOUNTAIN MICRO

Lately I've been hearing that you want to program erasable read-only memories (EPROMs). It seems you want to create your own program cartridges, or make changes to your Basic ROMs, or turn your CoCo into some different animal.

The problem is, most EPROM programmers cost over \$100, and \$100 is big dues to pay. You want to burn EPROMs, not get burned in price — or quality.

So, I've put together the Color Burner, an EPROM programmer that will burn all the "27" family — 2716, 2732, 2764, 27128. Yes, it will also burn 68764 replacements for your Basic ROMs and, no, it won't break your budget.

Although my Color Burner doesn't cost a whole lot, you won't get burned over quality. I don't cut corners in hardware. I use the best fiberglass boards, with gold edges, protective solder masking and silk-screened legends. Before I send you a Color Burner, I test it by actually programming an EPROM.

So how can it be good if it's so inexpensive? First of all, you can only get a Color Burner from Green Mountain Micro. No dealers are adding to its price. Second, it isn't fancy. No high-tech power supplies are in sight. You've got to add three homely, low-tech 9-volt batteries to get it

going. Finally, it won't set new standards of complexity. It's simple, hardworking and reliable.

You can get your Color Burner complete or *a la carte*: try an assembled and tested unit, a kit, or just a bare board. Order it with or without programming software. Both kits and assembled units come with over 40 pages of documentation, complete program listings, and schematics. Nothing is hidden.

You'll burn those EPROMs, you won't get burned, and my technical support staff will keep you from getting burned up if you have a question or need help.

You Won't Get Burned with The Color Burner

- Assembled/tested with software, \$69.95.
- Assembled/tested only, \$64.95.
- Complete kit with software, \$56.95.
- Complete kit only, \$49.95.
- Board/documentation with software, \$30
- Board/documentation, \$23
- Bare board only, \$20
- ColorPack 8/16K ROM/RAM cartridge kit, \$19.95.
- 2716 and 2732 EPROMs available.

Specifications:

Programs 24/28-pin EPROMs, providing 21/25-volt programming pulses under software control. Includes unwired personality module. Requires three 9-volt batteries (not included). Tape software supports 2716 through 27128 and 68764/66 EPROM families, and requires 32/64K Extended Color Basic.

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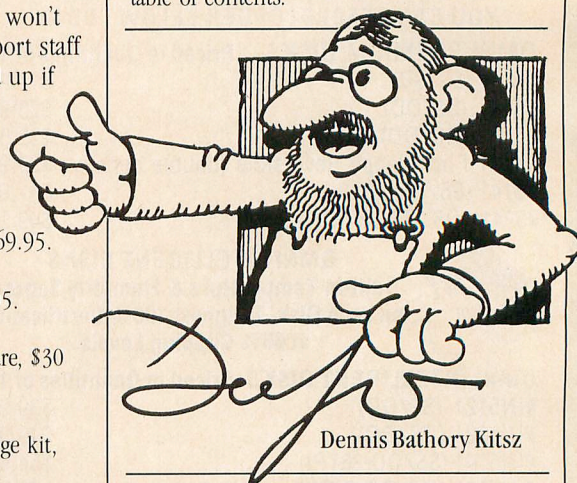
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try to shoot the bird. "Lunar Lander" has you land a spacecraft on Luna. To do it right you must reach zero altitude at zero velocity, otherwise you crash. And in "Horse Race," "every horse has an equal chance of winning," says the Shack.

Basic Programming Utilities and Print Spooler

Computerware
Box 668
4403 Manchester Avenue
Suite 102
Encinitas, CA 92024
(619)436-3512

The Basic Programming Utilities and Print Spooler comes with five utilities. "Sprint" sets up a print buffer so you can print as your computer keeps working. "BasRef" prints a variable and line number cross reference list. "Vdump" prints values of all variables. "CCexpand" combines Sprint with a 51-character by 24-column screen, a 25K

printer buffer. "Fixdir" cleans up Basic's disk directory, offering an alphabetized directory, program information, and a disk map. The package costs \$19.95 on tape and \$24.95 on disk and requires 32K.

Spell 'N Fix II

Star Kits
Box 209
Mt. Kisco, NY 10549
(914)241-0287

Spell 'N Fix II splits your screen into two windows. The top window shows text as it's being read. The bottom shows program status, misspelled words, and possible alternative spellings. It comes with a 20,000-word dictionary and room enough for another 20,000 words, technical and foreign words included. Once a word is corrected Spell 'N Fix remembers both the incorrect and correct versions and will suggest the correct one if and when the incorrect version is encountered again. The pro-

gram requires a 32K system and a disk. It, plus the manual, costs \$69.29. The original version costs \$49.39 and owners may upgrade for a modest charge.

A Critic's Guide to Software for CP/M Computers

by Phillip I. Good
Chilton Book Company
Radnor, PA 19089
(800)345-1214

This \$12.95 paperback has four sections: one on the programs everyone needs, one on mathematical and statistical software, one on successful software selection, and one on software for the programming professional. Besides covering word processors, spreadsheets, and database managers, the book discusses business, accounting, agricultural, legal, and management software, languages, and software directories. Oh yes, there's an appendix on games, too.

Car Manager

80 Custom Software
5720 Brooke Lane
Sylvani, OH 43560

Compute your mileage and how much it costs to operate your vehicle per mile, and keep track of your gasoline, maintenance, and repair costs with Car Manager. Records can show up on your screen or printer. This program costs \$12.95 on tape, \$15.95 on disk, and requires at least 16K.

Stock Tracking

Parsons Software
118 Woodshire Drive
Parkersburg, WV 26101

Investors will be interested in two programs from Parsons, Fundgraph and Fundfile, both disk based. Fundgraph costs \$69.95, runs on 16K or 32K, and offers analysis of stocks or funds. Fundfile, for \$37.95, requires 32K and analyzes portfolios. Each works independently of the other.

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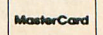
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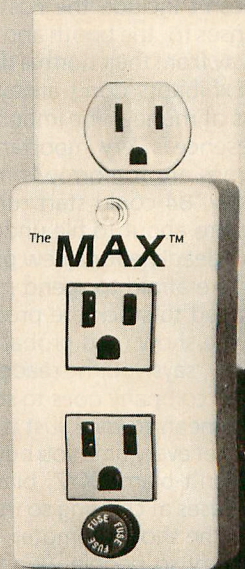
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he books, disks, computers, and furniture in my office are buried under an inch and a half of dust. I haven't seen this for myself; my wife went to the office a few days ago to pick up my paycheck and told me about it during our phone conversation that night. She called to thank me for the birthday card I sent her, and to tell me the puppy we got last Christmas is almost full grown. I'll bet he's a handsome dog. Caron, if you're reading this, please send a picture of Otis to me in care of The Next Computer Show, to be held for too many days in Yet Another Exciting Location, USA.

Please excuse the personal note, I barely have time to write letters home. Oh sure, the occasional post card... but it's hard to squeeze much writing onto them, and I'm usually in a hurry as I scribble a few words at the boarding gate while waiting for my flight to Yet Another Exciting Location, USA.

If this sounds like a personal problem, you're mistaken. Software and peripheral companies, magazines, hardware manufacturers, and OEM salespersons all converge on city after city, week after week, to be at The Next Computer Show which, by the way, promises to be "The Biggest and Best, Most Comprehensive Collection of Formatted Data Disks Ever Assembled in One Location." Oh boy, can't miss that one. Better get another Master Card for expenses, the other four are full. At the show I see familiar faces from the previous show, and the one before that, and come to think of it, the 10 before that. If I saw my wife that often I wouldn't have to wear a name tag when she picks me up at the airport.

Still sound like a family problem? XYZ Software Company, your favorite Color Computer software vendor, goes to five computer shows in 1984. Joe Sector, the company president, sends at least two employees to work the booth. They arrive in the show's host town the day before the show (to set up) and leave the day after (to break the booth down). The show lasts three days, so the employees are there for five. They stay in a hotel convenient to the show location. By the time they return to their home office, XYZ has spent thousands of dollars on transportation, hotel accommodations, food, taxis, and maybe some entertainment. This doesn't include the cost of being in the show, freight expenses for the booth and show materials, and employee time away from their normal daily work load at the office.

Exhibitors don't always go to shows expecting to make lots of money. The important thing is being there; *presence*. Presence is very important in this industry where today's big names are tomorrow's memories. Not showing at CompuShow '84 could start rumors of XYZ's shaky finances, that they're about to file under Chapter 11, or missed a production deadline for a new product. Soon all of XYZ's retail dealers are afraid to spend money on their products, preferring instead to stock the products of their competitor who was at the show (and probably started all the rumors). Okay already, says you the reader, we can see why our favorite software company goes to so many computer shows, so what's this mean to me? Just a dollar or two or three out of your pocket every time you buy a piece of XYZ software.

Don't blame XYZ, blame the show promoters. They are geniuses at creating so many "must attend" events. Oh, yes, says the show promoter, we'll put one in every corner of the country so people won't have to travel far to attend, and we'll call them CompuShow East and West and North and South and Central and West Central and East Central.

Not long ago there were only a few shows and everyone went to them all. That was fine; you could depend on seeing people you had to see. For example, if I needed to meet with Mr. World Renowned Joe Expert and didn't want to make

a special trip to his office in Who Knows Where, USA, I would only have to go to The Big Computer Show knowing he would be there. With all the shows nowadays there's a good chance Joe Expert and I will not attend the same 50 shows, and one of us will have to make a special trip to see the other. Yes, I've heard of the telephone, but things tend to get accomplished faster when you talk about them in person.

The existence of too many computer shows serves no positive purpose. The success of the Color Computer proves it. I remember big showy booths by the likes of Texas Instruments, Atari, and Timex/Sinclair at shows like Comdex, CES, Northeast Computer Show, and West Coast Computer Faire. Nearby were all the folks supporting those machines with software packages and add-on products. How wonderful it all looked! By contrast, Tandy Corporation hardly ever appears at shows. Neither do the people in the TRS-80 support industry. Yet Tandy remains a strong force in the microcomputer market while the others have fallen like dominos on a tilted table, followed by many of the support folks.

If Tandy put on the dog at shows, the people you buy your software from would have to go to those gatherings also, just as those who support the IBM PC and Apple Mac must. And you, like owners of those other computers, might have to pay \$695 for a word processor, or \$59.95 for a game. I don't mind paying a fair price for software, but I don't want to pay for XYZ's trips to All Those Exciting Cities, USA. Do you?

Although the Color Computer has been able to stay aloof from most of the show glitter and hoopla, it is by no means immune. The same fear, of no *presence*, can occur in smaller special interest shows. Even in these smaller special interest gatherings, small companies find it difficult to compete with the ambitions of the relative few and are forced out of the competition not because their products are inferior, but because the cost of presence can prove to be too much.

The Color Computer support industry should be wary of hopping around the country at the behest of others. I used to get notices of a new Applefest almost weekly. Very few are held now; only two on a national scale. Very few Applefests does not mean fewer Apples in people's homes: the Apple IIe continues to sell well, as does the company's newest machine, the Macintosh. But people providing Apple users with fine software and add-ons could not afford the time or money necessary to maintain a home office as well as a road office. Many of the companies involved were small operations based in people's homes, doing business during evenings and weekends mainly as a secondary source of income, as are many of the Color Computer support industry. They could not justify the expense to support this secondary business, nor could they justify so much time away from their other jobs — their primary means of support. Their discontinued enthusiasm reduced Applefests to a more realistic number.

Show promoters who read this as an attack on their means of earning income are doing us a disservice. Market strength is not measured by the number of shows a promoter puts on. Totally eliminating shows would be a grand mistake: but I resent the disregard promoters have for my time.

I have severely cut back my show attendance schedule. I suspect I am not alone. I have asked my wife to get a refund on her reserved parking space at the airport and cancel at least two of her seven night classes at the university extension. No, I'm not becoming a stick in the mud. Like everyone I enjoy a little time on the road. I've just begun to emphasize the phrase *a little*; that's all.

—K.L., Editor-in-Chief

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SPELLING BEE I ... GRADE 1 & 2 SPELLING BEE III ... GRADE 5 & 6

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